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*The consolidation of Electrical World, Electrical Engineer and American Electrician*

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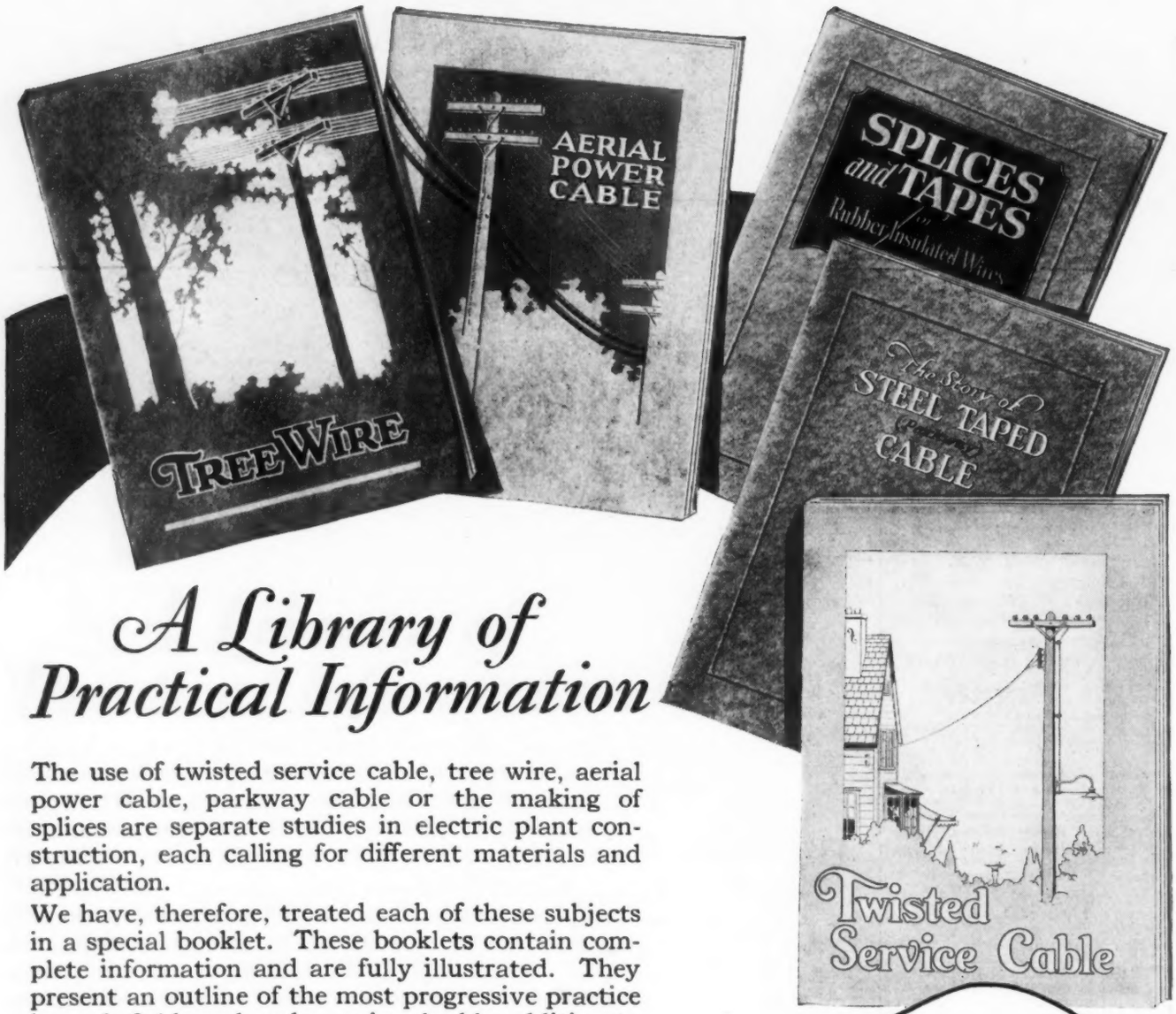
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## *The United Corporation's Significance*

ANNOUNCEMENT of the formation of another investment company last week is of significance to the public utility industry—not that investment companies are new or novel, for the banking world has been giving birth to them at a rapid rate of late and christening them with high-sounding names. But the particular company to which we refer is of noble lineage, one of its parents being the house of Morgan. Now, the banking firm of Morgan is internationally known and internationally minded. To the public it stands pre-eminent in reputation and performance. While the Morgans have been associated in the past with the electrical industry, the late J. Pierpont Morgan having interested himself in the development of the Niagara Falls Power Company and in the formation of the General Electric Company, much of the financing of the industry since those early days has been done by other bankers. To have the firm again interest itself in electric public utility work augurs well for the utilities and means much for their subsequent growth. It signifies that, financially speaking, the public utilities are coming into their own.

Moreover, it is gratifying that this recognition of merit follows closely on the admission of Harold Stanley, a son of William Stanley, the pioneer in alternating-current development, to the Morgan firm. Possibly Harold Stanley may have had nothing to do with the change of sentiment on the part of his house, but at any rate a change very acceptable and welcome by the electric public utility industry has taken place, and it is a pleasure to note that a son of Stanley is beginning to assert himself in an industry which his father's contributions and labors did so much to found.

* * * *

## *Another Chance for Maine*

ONCE more opportunity knocks at Maine's door. If the Legislature modifies the Fernald law so as to permit the exportation of surplus hydro-electric power, the promise of many millions of dollars of increased investment by utilities within range of the northeastern New England market has been made in good faith. Heavy waste of water, amounting on the Central Maine Power Company system alone to more than 150,000,000 kilowatt-hours in the past three years, will be lightened and revenue from corporate taxes increased, to the welfare of the entire state. Were such exportation now permissible, the Bingham Dam under construction would be built for a 175-foot head instead of 135-foot. Plans of broad scope would be materializing for hydro-electric and transmission developments whose delay puts off potential growth which should be in process of realization here and now.

Two years ago the old inhibition upon progress was sustained through political obstruction and lack of popular understanding of the real issues involved. Slowly the tide of public opinion is rising to admit Maine to electrical fellowship in the Northeastern States. An impartial investigation of the hydro-electric power surplus, potential and actual, is under way. This completed, little should stand in the way of constructive action. There has been plenty of experience in framing measures providing for regulation of exported power to safeguard the public interest, and if the question can be treated on its merits, the answer will be clear. If Maine elects to sit still and wait for industries to come, a measured development will doubtless continue under the public-spirited leadership of her business men; but other New England states are quickening to larger economic life as important power projects are being pushed forward, and the flow of energy into the markets to the southward will not wait indefinitely for Maine to awaken from her political stupor. Once more opportunity knocks at Maine's door.

* * * *

## *Award to Courtright Recognizes a Sound Principle*

THIS week the medal for co-operation given under the James H. McGraw award was presented to Henry H. Courtright before a distinguished gathering in San Francisco sponsored by the Pacific Coast associations of the electrical dealers, contractors, wholesalers and power companies. It was a notable recognition not only of a man but of a principle.

"Kelly" Courtright, as he is nationally known, is president of a subsidiary maintained by the San Joaquin Light & Power Corporation to merchandise domestic load-building equipment. The problem in the territory served by the San Joaquin system involved the distribution and sale of household appliances in some ninety-odd communities. Two courses lay open—to establish company stores in all these towns or to utilize the existing outlets already engaged in retailing household equipment of various kinds. Courtright elected to throw his influence into the upbuilding of the local trade already available. His operation was based on the payment by the San Joaquin company of a fixed commission per kilowatt of load sold onto the system from any source whatsoever. This money was spent in advertising, demonstrating and other services to stimulate the public demand and the merchandising activities of the electrical, hardware, drug, department-store and other dealers. He maintained only two stores of his own.

This experiment has brought an experience in load building and in trade relations that has been notable in its success. It has won the acclaim of all branches of the industry on the Coast, and the idea is already being applied in varied degree by other systems. It has contributed new thought to the progress of market develop-

ment in the electrical industry and new impulse to the encouragement of practical co-operation between the power industry and the appliance trade. The selection of Mr. Courtright for this award by a committee of Eastern men chosen from the directorate of the Society for Electrical Development and representing the four major branches of the industry is a splendid tribute and one that is well merited. It gives recognition to a sound principle in the field of trade relations, now growing to increasing importance.

* * * *

## *What Is Good Street Lighting?*

WHEN is a street properly illuminated? From the motorist's viewpoint the driver of a car must be able, at existing speed limits, to distinguish without fail street intersections and inequalities in the road. He must be able to judge the speed of approaching objects and see without error where pedestrians are.

How is this obtained? High light centers and evenly distributed light, with slightly more light at corners, will give the desired result. Glare both from the light source and reflected from the wet streets should be eliminated so far as is possible. With the maximum of light at a given distance above street level and evenly distributed these factors will be obtained.

There are many towns and cities where the street-lighting units are so scattered as to give the effect of distributed darkness—which to the motorist is worse than no light, only adding to the confusion of passing cars. There are others in which a motorist plunges from darkness into a brilliantly lighted "white way" with a consequent blinding effect. Good street lighting is not the amount of light in foot-candles emanating from a source; it resides in the proper distribution of this light.

* * * *

## *Changing Attitude Toward the Small Wiring Contractor*

WHAT men think today they put into action tomorrow. There is a real significance, therefore, in the changing attitude toward the small contractor that is evident throughout the electrical industry.

It wasn't very many years ago that in any gathering of electrical men where the problem of house wiring was under discussion a general denunciation would be directed toward the "curbstoner," or the "carpetbagger," or whatever he might be called. The fact that in every city there were so preponderant a number of these irresponsible wiremen doing business "on their own" and getting work by scalping jobs and cutting prices was held to be a menace to the industry. But nothing was done about it, and the number of contractors continued to increase from fifteen thousand in 1920 to twenty-two thousand in 1924 and to thirty thousand in 1927, though the number of houses wired fell off rapidly in 1925. The intensifying competition for jobs naturally influenced directly against the size of installations and the adequacy of the facilities provided for the enjoyment of electric service.

Gradually, however, the matter of adequacy in house wiring has come to be a major concern. It is recognized also that the industry must depend upon this same small contractor to do this work, because the larger contractor cannot afford to bother with these small jobs at a low price. Electrical men have, therefore, begun to turn from the old practice of cursing the "curbstoner" to a serious consideration of his malady and a search for the cure. They find that it is not primarily an ethical problem but an economic one. The trouble is not that the small contractor is incompetent and untrustworthy; there are many good men among them. But they have been doing business on an unsound basis. What they need is not abuse, but education, guidance and encouragement.

Believing that this help can come only from the ranks of the contractors themselves, the Association of Electragists has now embarked upon an energetic program of local organization. It is establishing chapters in the cities. These local groups will work to build up unity of policies and practice in this branch of the industry. They will bring the small contractor into line with advanced thought by interesting him in better estimating, cost keeping and general business methods, more adequate installations and the selling of more complete appliance equipment. Here is positive action in the right direction.

Manufacturers, wholesalers and power companies can well afford to support this work with hearty assistance and co-operation in every locality. Above all else, the small contractor needs the enlightening experience of prosperity. He can only get this for himself. But he can be shown where and how to find it. And the first thing to do is to stop calling him names.

* * * *

## *Higher Voltages for Generators*

GENERATORS ever grow in size, transmission lines ever grow in length and voltage, but the generator voltage remains forever. So it would seem when looking back upon the enormous development of the electrical industry in the last few years. Nothing stood still; everything seems to have progressed except the generator voltage. Is there a law of nature or a constitutional amendment against the use of a generator voltage over 13,800? To be sure there are difficulties. But were there no difficulties in designing huge transformers and turbines or 220-kv. oil breakers? The study and development of insulating materials, iron and other features affecting generator design has not stood still; a great deal more is known about these features than was known twenty years ago, and more can be done with them.

Radical changes in apparatus are only seldom initiated by manufacturers. They are more often brought about by the intelligent and farseeing purchaser, who goes about finding out what can be done and then requests that quotations be submitted accordingly. For many years distribution and transmission in large cities were done at 13,800 volts; but 22,000 volts is becoming quite common for such purposes, and 33,000 volts will soon be very popular. Generators rated at 22,000 volts are now being asked for by some purchasers, and in the near future many utilities will no doubt request manufacturers to bid on 33,000-volt units, and the manufacturers will find means to build such units. They found means in the past to build 13,800-volt generators when anything over 2,300 volts, or at most 6,600 volts, was considered impossible.

The 33,000-volt generator will come as a result of the recent tendency of public utilities to simplify their stations. It will eliminate troublesome transformation and unnecessary switching.

## *Let the Engineer Decide*

EXTREMES of opinion are current in the power industry as to the future course of hydro-electric development, although the advocates of fuel-burning plants have in many cases succeeded in putting champions of water power more or less upon the economic defensive. While the final responsibility for undertaking a water-power development is the financier's, there never was a time in electrical history when the need of sound engineering analysis was so great in this field as today, regardless of the size of the project.

Addressing the Bond Club of Boston last week, J. E. Aldred showed that changes in the engineering and economic aspects of hydro-electric practice have shifted values in a way that makes generalization dangerous. For example, he contends that the increased efficiency of hydro plant and transmission facilities more than offsets the increased interest charges on the greater capital required today per horsepower. In regions affording a market for electrically generated steam, he points out that it is now common practice to develop a hydro plant to its full capacity, even though the full rating cannot be used on permanent contracts at the outset. Because fixed charges constitute such a large percentage of hydro-electric power costs, it is much more feasible to execute long-term contracts embracing guarantees as to prices for energy.

America has much to learn from Europe in hydro research. In this country studies of wave forms in diversion conduits, or of what might be termed hydraulic attenuation, are being made with the aid of models and intricate mathematical analyses. Because of economic and other shifting values in the hydro-steam picture, the engineer with broad grasp of hydro practice and specialized ability is being increasingly recognized as vital to the success of specific projects of even minor importance.

* * * *

## *The Phenomena of Circuit Interruption*

PROCEEDING upon the assumption that only by a separate study of the numerous variables involved can a true comprehension of the nature of circuit-breaking phenomena be gained, the British Electrical and Allied Industries Research Association has had under way since 1922 a thorough and painstaking investigation of arc rupture and dielectric fluids. Many interesting contentions have been developed and valuable data secured.

It was concluded early in the investigation that in the case of oil dielectrics the arc is often broken while the contacts are still within the gas bubble, so that arc extinction is not due to the quenching effect of the oil. Further experiments then proceeded toward a study of the gas formed, and of its arc-rupturing properties as compared with other gases, with a view to full utilization of the advantages of gas or oil and with the possibilities in mind of using either fluid or both in new or improved designs. Determinations were greatly facilitated by the use of a high-speed camera for critical examination of the arc globule. Photographic and oscillographic records were co-ordinated.

While the investigators concluded that the critical arc length could be shortened by cooling with gas blasts and that specially designed breakers using hydrogen, air or other gases may be highly satisfactory, they still contend that oil has extremely valuable properties. For example, it is broken up by the arc, causing hydrogen gas, which has much better cooling properties than air; it effectively insulates the contacts from each other and from ground; reduced internal clearances are possible, and a cooling and condensing surface is offered close to unprotected insulated surfaces which would otherwise rapidly lose their insulating properties by becoming covered with deposited copper. The presence of oil may have bad or good effects, according to the way in which they are controlled by the designer.

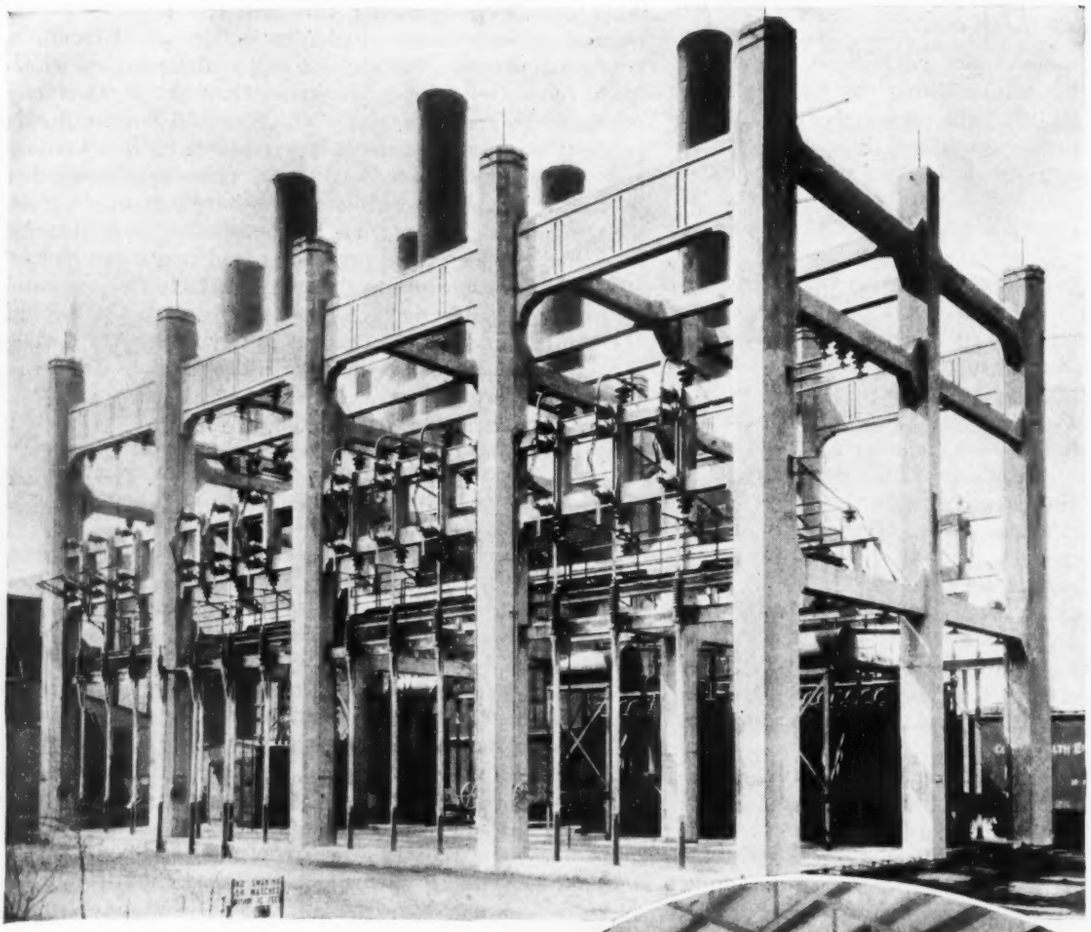
Definite, fundamental changes in circuit-breaker design are on the way and inevitable. Just what they will be is as yet indeterminate. Whether they concern vacuum, deion, gaseous, improved oil dielectric or as yet untold designs, the principles deserve the thoughtful consideration sometimes denied to the untried idea. The British Electrical and Allied Industries Research Association has sponsored a worthy cause.

* * * *

## *Keeping Interest in Safety Alert*

FAMILIARITY with conditions dulls the edge of interest in preventive work of many kinds unless leadership is constantly pressing home its importance by concrete illustrations, the appeal to competition and the attraction of fresh ideas. Safety engineering in electric utilities and manufacturing plants is always being handicapped because the rewards of accident prevention are indirect, and because of the persistence of routine and the difficulty of mustering originality to its service. The era during which personnel can be impressed by "safety first" signs plastered all over plants passes away long before the polish on such signs fades. Admonitory preachings in company house organs soon become boresome unless accompanied by the saving salt of a fresh viewpoint.

Plentiful resources are at hand for strengthening the interest in safety, without which flabby indifference descends upon rank and file, to be followed as day by night with a distressing crop of accidents if not fatalities. "Close-up" engineering photography has only begun to be utilized as it should be in many companies to depict unsafe conditions by effectively illustrated bulletins based on local conditions in preference to "canned" situations. The pages of company papers are open to far more enlivening material of a graphic nature than has often been presented in the past. In not a few organizations the power of simple, rough, reproduced sketches of accident causes and preventive schemes, to set forth telling lessons of motor-vehicle collisions and upsets in company territory or to point a moral in construction and operating fields, has yet to be fully grasped. The interest-maintaining capabilities of continuous competition to reduce the number and lost time of accidents between departments and divisions, as set forth by daily logs or other displays, are by no means exhausted. An "exchange of pulpits" by picked inspection forces between properties has potential uses largely untried. Finally, the preparation and filing of more complete safety engineering data and illustrations deserve wider attention. A resolution to vitalize safety engineering along these lines is before the house for action as the clean pages of a new year open to the industry. But all the details of procedure must be based on executive responsibility and discipline.

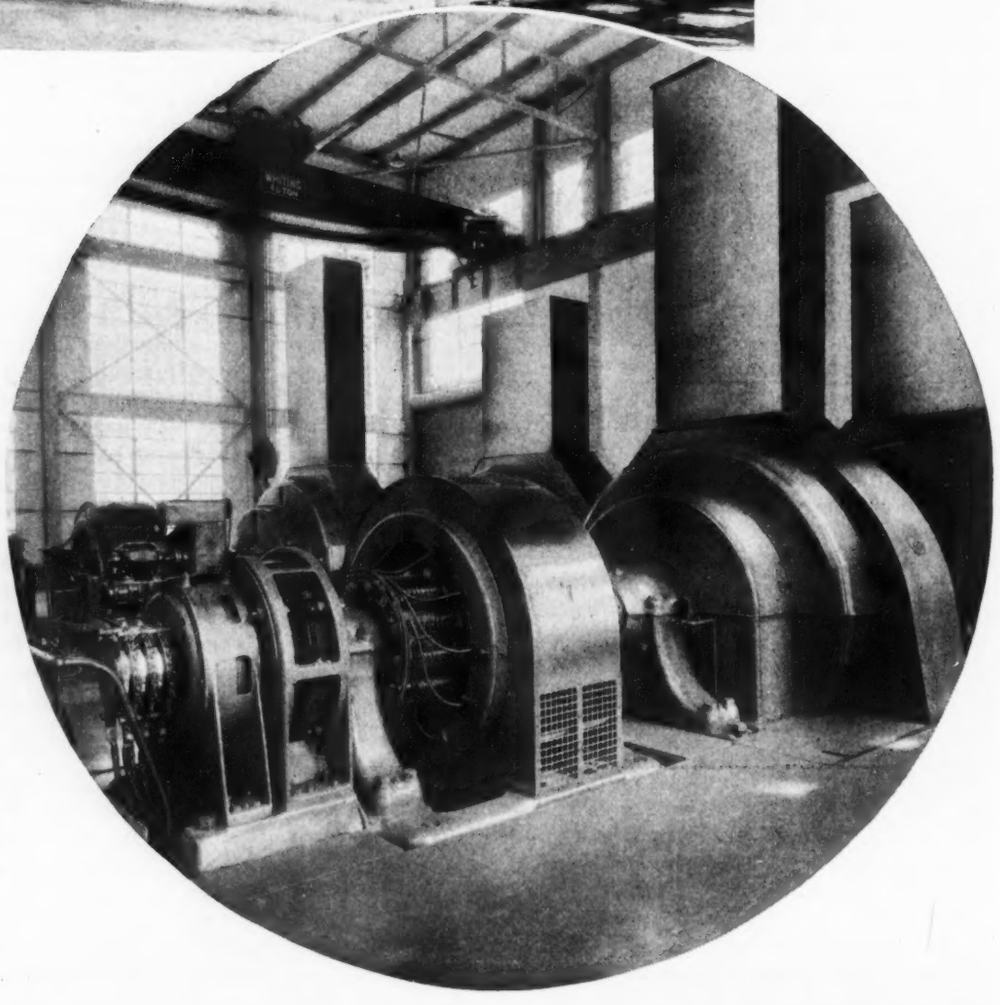


*At Northwest substation concrete is substituted for steel*

# *Unusual Variations in Design*

THE appearance of the frequency-changer equipment at the Devon power plant of the Connecticut Light & Power Company is strangely altered by the use of high rectangular stacks.

A distinctly architectural touch appears in the outdoor substation at the Northwest plant of the Commonwealth Edison Company. Concrete rather than steel sections have been used. Each pier is provided with lightning rods.

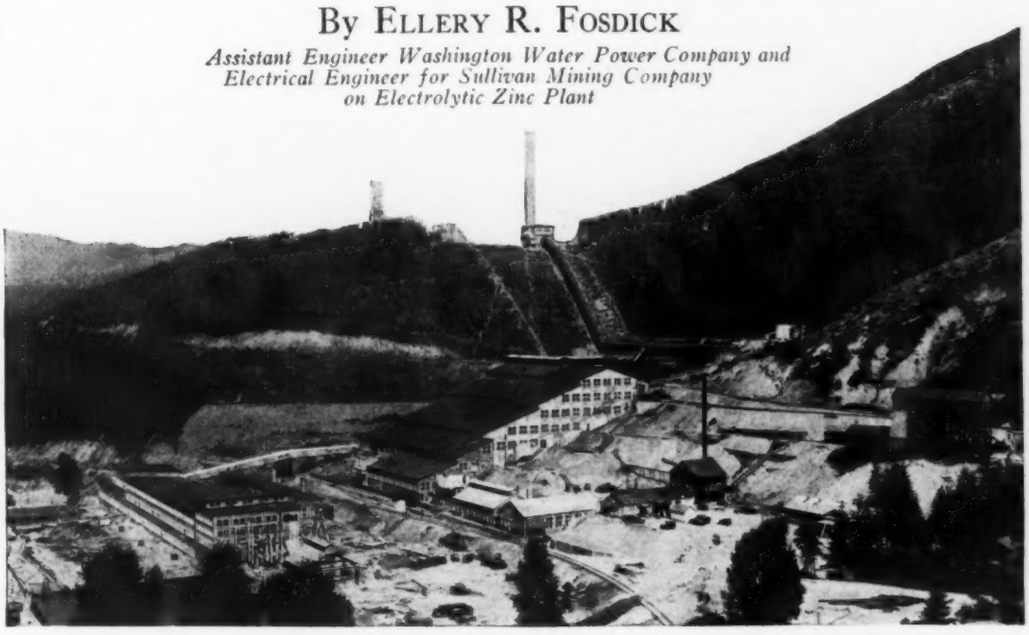


# Electrolytic Zinc Production

## *by "Tainton-Pring" Process*

By Ellery R. Fosdick

*Assistant Engineer Washington Water Power Company and Electrical Engineer for Sullivan Mining Company on Electrolytic Zinc Plant*



*Electrolytic zinc plant of Sullivan Mining Company, Kellogg, Idaho*

**First plant employing new process placed in operation at Kellogg, Idaho. Handling of high currents, voltage regulation, ventilation and lighting presented problems**

THE first plant to be built for the commercial production of electrolytic zinc by the "Tainton-Pring" process is that of the Sullivan Mining Company at Kellogg, Idaho, placed in operation in September, 1928. The plant, which has a nominal capacity of 50 tons of slab zinc per day, with provision for increasing to 150 tons daily, utilizes 16,000 amp. at 500 volts direct current supplied by two synchronous motor-driven generator units. The Tainton process differs essentially from other processes which have been in commercial use for a number of years in that strong sulphuric acid is used in leaching and high current density is applied in electrolysis. Commercial application of the process is expected to result in lower production cost and greater purity of the refined zinc.

At present the ore is derived from the Star mine near Mullan, Idaho. A complex silver, lead, zinc ore from this mine is hauled through an 8,900-ft. crosscut to the 2,000-ft. level of the Hecla mine, raised up the Hecla shaft and shipped to the Star concentrating mill at Kellogg. The zinc concentrate from this mill is then taken to the bins of the electrolytic zinc plant, about a mile distant. This being a custom plant, zinc concentrates from sources other than the Star mine also will be treated. The zinc concentrate is roasted and the roasted calcine is leached by hot sulphuric acid of 28 per cent concentration. Dissolving of the zinc concentrate in the acid gives an impure zinc sulphate solution. After being purified, the neutral zinc sulphate solution goes to the electrolytic cells, where the zinc is deposited upon aluminum plates by electrolysis.

The Sullivan Mining Company derives its power supply from the Washington Water Power Company over a 110-kv. line and a 60-kv. line, with a third source available from an interconnection between the lines of the Washington Water Power Company and the Montana Power Company. Facilities for serving the electrolytic zinc plant are shown by the accompanying single-line diagram. Under normal operating conditions these three lines are connected to the same bus in the Washington Water Power Company's switching station, but will clear themselves selectively in case of trouble. A single 10,000-kva. transformer bank belonging to the mining company steps down from 110,000 volts to 2,300 volts for distribution throughout the plant over five feeders serving various points.

Power supplied to the mining company is metered at 110 kv. in the power company's switching station. The total load taken by the plant is metered on the high-tension bus in the substation of the mining company as well. Also the power supplied to each of the two motor-generator sets and to the individual plant feeders is metered at 2,300 volts.

### Motor-Generators Selected for D.C. Supply

After considering the daily output of zinc required and the type of electrolytic cell to be used, in conjunction with the economical size of generating equipment available, it was decided to use 8,000 amp. at 500 volts d.c. for the normal cell current. With this as a basis for comparison the question arose as to the type of generating equipment best suited to the needs of this particular plant, namely, whether synchronous motor-generator sets or rotary converters would be most satis-

factory. In weighing the relative advantages of the two the following factors were given consideration:

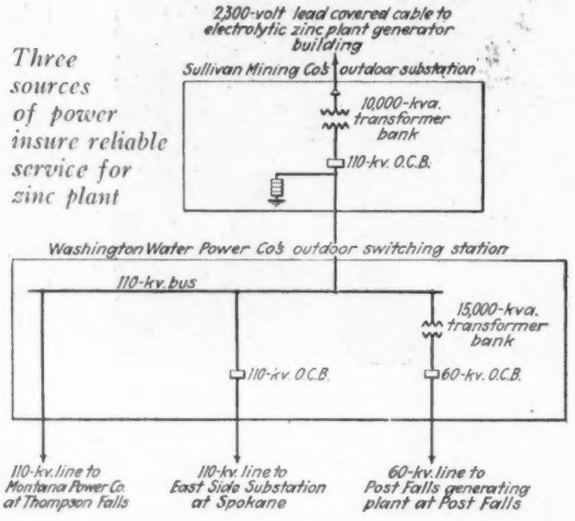
FACTORS CONSIDERED IN DETERMINING POWER SUPPLY

1. Transient a.c. line conditions are reflected on the d.c. side of converters and are apt to cause commutator flashing. Converters are more liable to flash when located at the end of a long transmission line. Transients are not reflected on the d.c. side of motor-generator sets and hence shutdown and outage are considerably less.

2. Converters are more sensitive to unbalanced a.c. voltage than synchronous motors and will show heating and disturbed commutation.

3. Operated at other than unity power factor converters will heat and commutation will be disturbed, whereas motor-generators are not critical to off-unity power-factor operation and moreover may be utilized to correct the power factor of the total plant load.

4. Motor-generators are capable of a wide range of voltage by means of a single device, a field rheostat, a very desirable feature in this particular plant, where improvements in the technique of the electrochemical process may necessitate

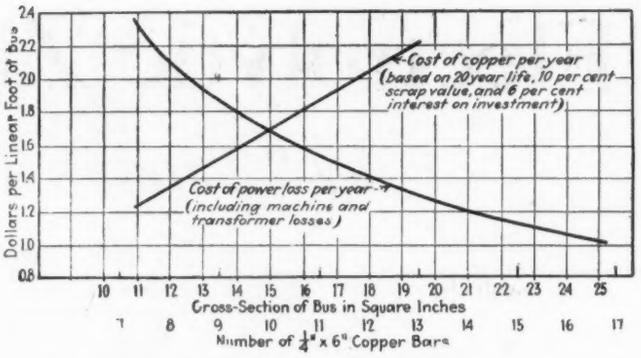

Three sources of power insure reliable service for zinc plant
2,300-volt lead covered cable to electrolytic zinc plant generator building
Sullivan Mining Co's outdoor substation
10,000-kva. transformer bank
110-kv. O.C.B.
Washington Water Power Co's outdoor switching station
110-kv. bus
15,000-kva. transformer bank
110-kv. O.C.B.
60-kv. O.C.B.
110-kv. line to Montana Power Co. at Thompson Falls
110-kv. line to East Side Substation at Spokane
60-kv. line to Post Falls generating plant at Post Falls

changes in cell voltage. To obtain a sufficient degree of flexibility with rotaries a booster unit must be provided to control the a.c. input. Such a unit adds 15 per cent reactance to the a.c. circuit at zero buck-and-boost and when bucking or boosting disturbs commutation. Moreover, when a booster is made automatic to provide a constant output of the rotary converter it results in so many automatic adjustments that more skilled operation and maintenance are required.

5. The efficiency of rotary converters is higher than that of motor-generators, but the advantages of the latter above enumerated usually will more than offset the slight difference in efficiency.

After carefully studying the above factors in conjunction with the demand to be made upon the machines and the reliability of the source of power, two three-unit synchronous motor-generator sets were chosen. The motor of each unit is rated at 4,400 kva., 2,300 volts, three phase, with a speed of 514 r.p.m. On each end of the motor shaft is a 4,000-amp., 500-volt, shunt-wound d.c. generator. A direct-connected exciter supplies field current for both the synchronous motor and the d.c. generators. These synchronous motor-generator sets have an efficiency of 92 per cent at full load and unity power factor.

Ventilation of the generator room and the machines presented a problem owing to the presence of acid-laden gas in the vicinity of the zinc plant. Hence, all air taken into the machines is thoroughly washed and the interior of the generator room is constantly kept under a static pressure of about $\frac{1}{8}$ in. and $\frac{5}{8}$ in. in the basement. Metal fittings and insulation of electrical apparatus are thus protected from the attack of acid fumes. The generator


Dollars per Linear Foot of Bus
Cost of copper per year (based on 20 year life, 10 per cent scrap value, and 6 per cent interest on investment)
Cost of power loss per year (including machine and transformer losses)
Cross-Section of Bus in Square Inches
Number of ¼" x 6" Copper Bars

*Power-loss and copper-cost curves show most economical bus cross-section for 8,000-amp.*

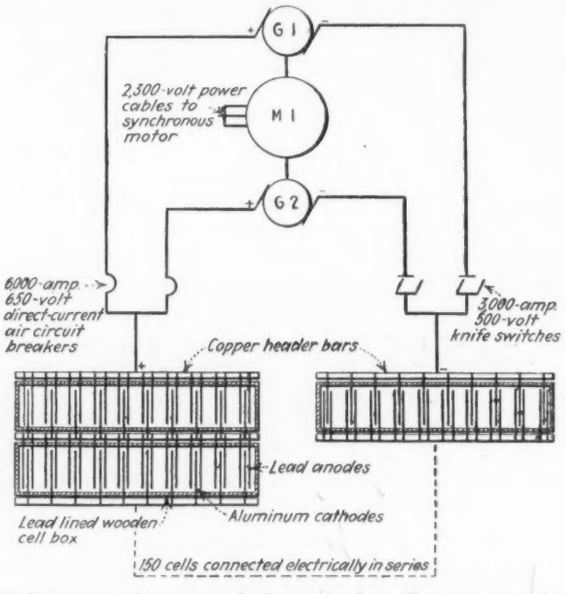
building is used as the inclosure for the ventilating system, the air discharged from the air washers through the blowers passing into the basement and upward through the machines before it is discharged into the main part of the generator building. From the main building the warm air is drawn down through the intakes into the washers and again discharged into the basement, thus completing the cycle. The present machines each requires 72,000 cu.ft. of cooling air per minute, which is supplied by two single outlet, duplex, conoidal fans, each driven by a 25-hp., 440-volt motor.

## BUS CALCULATIONS

The copper buses connecting the generators to the electrolytic cells are quite long. They carry a current of approximately 8,000 amp., which does not vary more than 4 per cent, and it was therefore necessary to make a careful study of heating losses. Based on the curves shown, it was decided that 15 sq.in. cross-section is most economical for 8,000 amp. or a current density of 533 amp. per square inch.

## AUTOMATIC REGULATION

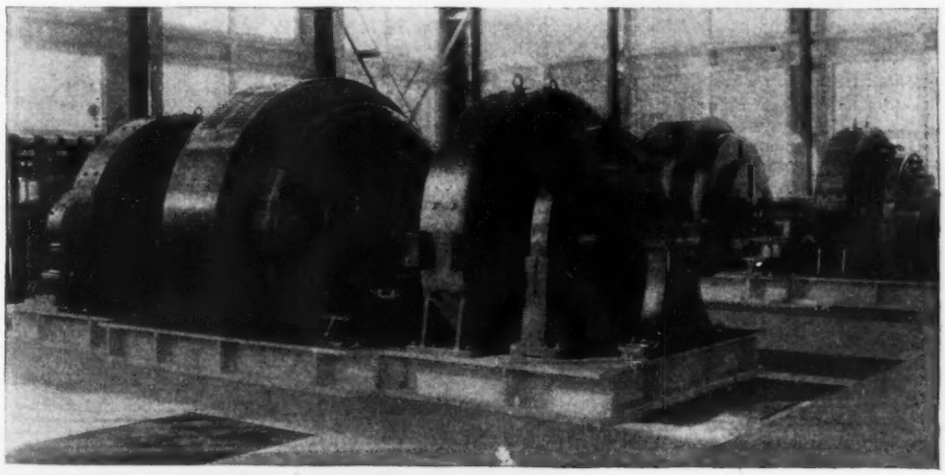
The cyclic variation of conductivity of the electrolyte, taken in conjunction with periodic shutdown of electrical apparatus for cleaning, oiling and brush attendance, made it imperative to adopt some means of obtain-



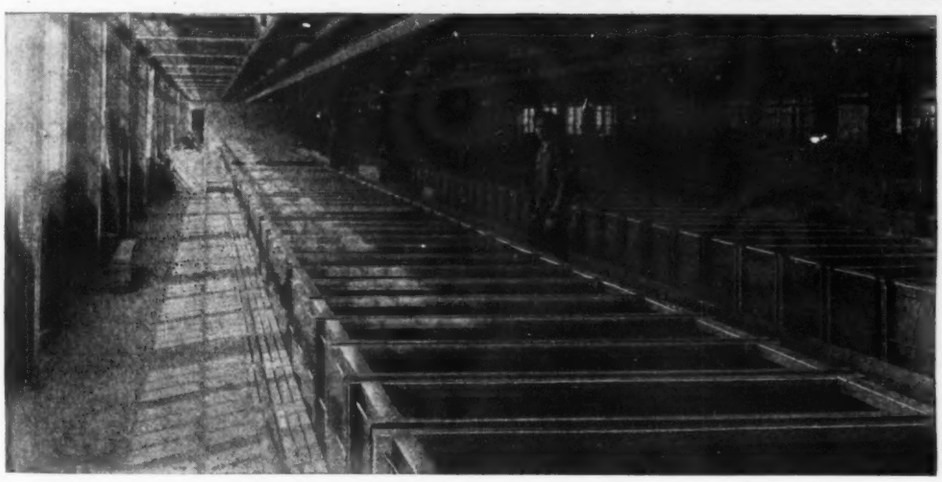

*Schematic diagram of electrolytic cells and supply circuit at Kellogg zinc plant*

ing constant kilowatt input to the synchronous motors in order to maintain the desired load factor. A new type of regulating equipment, believed to be the first of its type to be used for electrolytic zinc plant regulation, was furnished by the General Electric Company.

Current and potential transformers in the 2,300-volt power cables to the synchronous motors of the motor-generator sets have their secondaries connected to the control element, or contact-making wattmeter, of the automatic regulator, which is mounted on a control panel of the main switchboard. This control element through a timing device closes one of two pairs of contacts at regular intervals or does not permit either of them to close, until some fluctuation in load causes a change in power taken by the synchronous motor. When a pair of contacts close they complete a circuit by means of an auxiliary contactor through the field-rheostat head, causing the driving motors to rotate the field rheostat brush arms. This regulates the field current and changes the generator load, either increasing or decreasing it as required to maintain constant the power taken by the synchronous motor.



*Cell room before lead anodes and aluminum cathodes were placed in lead-lined wooden cells*



*Three-unit synchronous motor-generator sets supply 8,000 amp. each at 500 volts d.c. for electrolytic deposition of zinc*

### Electrolytic Cells

Two groups of electrolytic cells, each containing 150 cells, operate with the cells connected electrically in series, as shown by the accompanying schematic diagram. Each cell consists of twenty cathodes having two lead-alloy anodes, one on either side of the cathode at a distance of ½ in. The lead-alloy anodes are perforated with square holes, being made in the form of flat grids, while the aluminum cathodes are smooth, flat sheets. Anodes and cathodes are suspended in the electrolyte contained in a lead-lined wooden box. Each cell box is insulated from the supporting structure by four glazed bricks, one under each corner of the cell. The midpoint of the cell circuit is grounded, thus reducing the voltage to ground to a maximum of 250 volts. Insulating of the cells and grounding of the cell circuit is for the combined purpose of reducing stray current leakage and protection to the operators from high voltage.

Purified zinc sulphate solution is fed to the cells in a parallel flow and recirculated until about 90 per cent of the zinc has been extracted. The solution contains approximately 28 per cent acid, after 90 per cent of the zinc has been removed. At intervals after the solution has reached this condition of acidity a portion is removed to the acid storage tanks, being replaced by purified zinc sulphate solution containing more than 20 per cent zinc. The process with respect to the electrolysis is continuous, but is cyclic with respect to the zinc content of the solution.

The electrolytic zinc deposited on the aluminum cathodes is stripped off at intervals varying from 12 to 24 hours without interrupting the cell circuit. A cathode is disconnected from its clips, raised and suspended above the cell for drainage of acid electrolyte and after being stripped of zinc is replaced in its copper clips. While this is being done the other cathodes in the cell function as before except that they equally divide the additional current imposed upon them when the cathode to be stripped is disconnected from its clips. The current density at the surface of the aluminum cathode is approximately 100 amp. per square foot and the voltage per cell averages 3.55 volts.

In calculations on zinc tonnage a current efficiency of 85 per cent is used. It may be somewhat higher than this under normal operating conditions, but at times falls below this figure due to impure solutions.

Artificial illumination of the cell room is necessarily of importance and must be of high intensity since the work of stripping the deposited zinc and of regulating the solution flow must be carried on 24 hours a day. To

meet these requirements an average intensity of 6 ft.-candles was provided. The air in the cell room is always laden with a mixture of dilute sulphuric acid and zinc sulphate solution. Hence all lighting fixtures and fittings must be of acid-resisting material. The lighting units consist of galvanized cast-iron vapor-proof condulets, upon which are mounted type RLM porcelain enameled steel reflectors with a gas-tight globe to inclose the incandescent light. Duplex lead-covered cable enters the condulets through a bronze packing unit and base and is sealed with a rubber gland.

The installation was designed with the management requirement in mind that highest economy would result from a system requiring the least maintenance with maximum service.

# Large Rotor Heated Electrically for Shaft Assembly

THE problem of heating a 45,000-kva. generator rotor weighing 132 tons for a shrink fit on a 46-ton shaft 39¾ in. in diameter was successfully solved by the Southern California Edison Company at its Big Creek No. 2-A plant by winding aluminum cable around the rotor, as shown in an accompanying illustration, and heating the mass of steel by eddy currents and hysteresis loss.

This method of heating the rotor has the advantage over steam or other methods of heating in that the temperature of the rotor is under absolute control at all times and the mass of steel is heated uniformly throughout. Moreover, it is less expensive and less time is required due to the fact that no piping and facilities for producing steam or other heat are required and besides the rotor

*Data on Electric Heating of Rotor for 45,000-Kva. Waterwheel Generator*

**Heating Coil** (1,210 ft. of cable).
29.5 turns of stranded aluminum steel core cable (area of aluminum 660,000 circ.mils).
Insulated from rotor with two layers of ⅛-in. asbestos and one layer of thin mica.

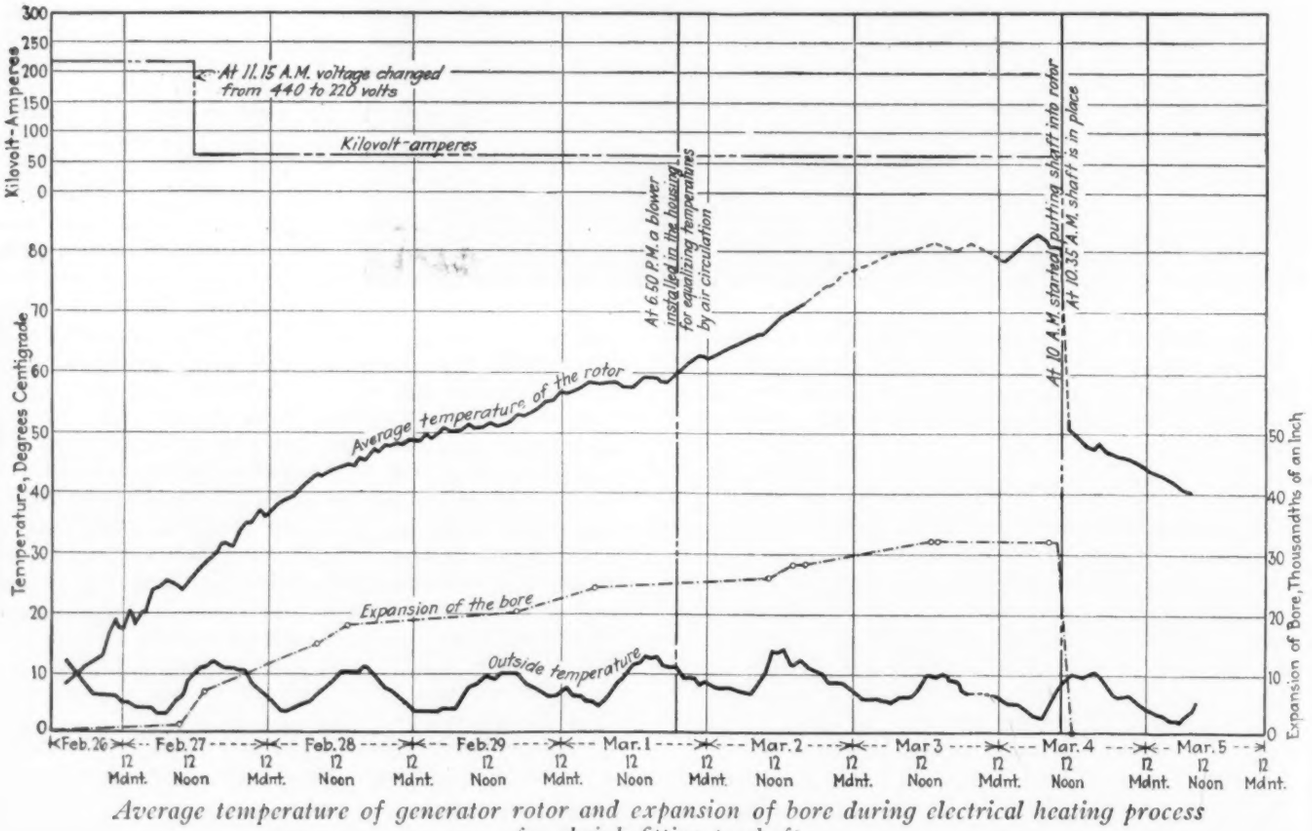
**Rotor Dimensions, etc.**
Width, 74¼ in.
Diameter, 150¾ in.
Diameter of hub A, 39.998 in.; B, 39.875 in.; C, 39,745 in.; D, 39.625 in.
Weight, 132 tons—264,000 lb.
Material, nickel steel; specific heat, 0.117 B.t.u. per lb. per deg. F.

**Progress.**
Heating started at 2:15 p.m., Feb. 26, at 440 volts.
At 11:15 a.m., Feb. 27, voltage changed to 220 volts.
Heating finished at 10 a.m., March 4. Expansion of bore, 0.032 in.
Started installing shaft at 10 a.m., March 4.
Finished installing shaft at 10:35 a.m., March 4.
No clearance between shaft and rotor at 12 noon, March 4.

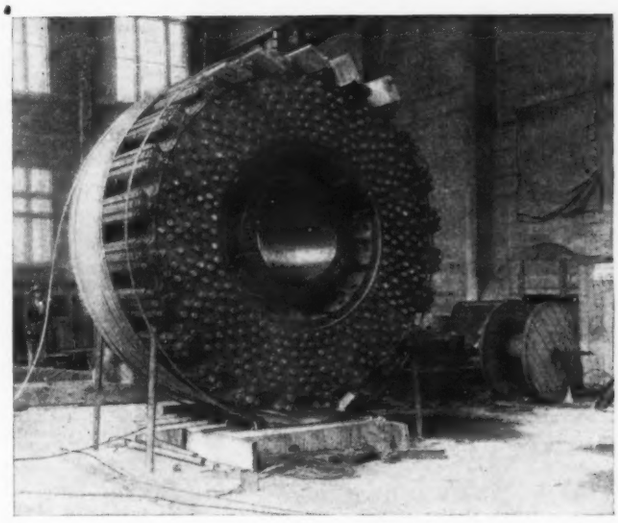
**Watt-Hour-Meter Readings** (K = 800).
Feb. 26, 2:15 p.m. = 0959.0
Feb. 27, 11:15 a.m. = 0959.9
March 4, 10:10 a.m. = 0963.7
} Fractions were obtained by interpolation on unit dial.

HEAT REQUIREMENTS FOR SHAFT ASSEMBLY

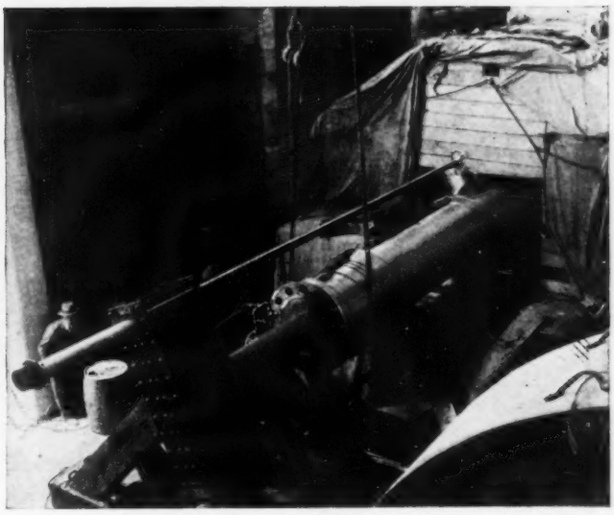
| | At 440 Volts | At 220 Volts | Over All |
|---|---|---|---|
| Duration of heating, hours | 21 | 142.75 | 163.75 |
| Net time power on, hours | 417 | 85.0 | 89.17 |
| Time power on, per cent. | 18.8 | 59.6 | 54.4 |
| Kilowatt-hour supplied to heating circuit | 720 | 3,040 | 3,760 |
| Kilowatts | 173 | 35.8 | ..... |
| Kilovolt-amperes | 219 | 61 | ..... |
| Power factor | 0.79 | 0.59 | ..... |
| Average temperature rise of rotor | 17.5 deg. C. = 31.5 deg. F. | 57.5 deg. C. = 103.5 deg. F. | 75.0 deg. C. = 135.0 deg. F. |
| Average temperature rise of rotor per kilowatt-hour | 0.0438 deg. F | 0.034 deg. F. | 0.0359 deg. F. |
| B.t.u. absorbed by rotor | 970,000 | 3,200,000 | 4,170,000 |
| Kilowatt-hour supplied to heating circuit | 720 | 3,040 | 3,760 |
| B.t.u. supplied to heating circuit | 2,460,000 | 10,380,000 | 12,840,000 |
| Efficiency, per cent | 39.4 | 30.8 | 32.4 |




*Average temperature of generator rotor and expansion of bore during electrical heating process for shrink fitting to shaft*



*Heating a 132-ton rotor by eddy current and hysteresis loss for shrink-fit shaft assembly*



*Placing a 39¾-in. shaft in rotor after electrically heating the mass of steel to 135 deg. F.*

may be placed in the most advantageous position for the shaft assembly.

Complete data on the heating coil, power consumption, time required, etc., are given in the accompanying table and curves.

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# Corona Eliminated in High-Voltage Generators

By Charles F. Hill

*Research Engineer*
*Westinghouse Electric & Manufacturing Company*

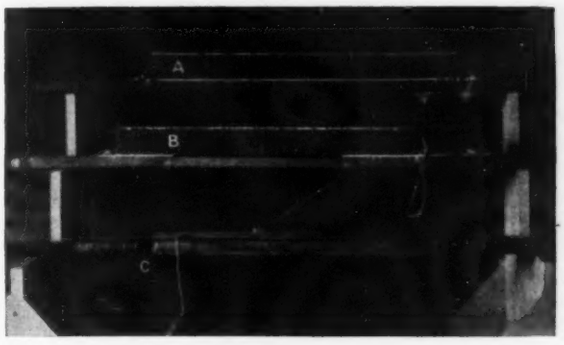
THE corona problem has been chiefly associated with transmission losses where the voltages are excessively high and where the corona is objectionable chiefly because of its loss in watts. Lower voltage applications introduce a different problem in that corona may have a deleterious effect upon the insulation with which it comes in contact, although the actual watt loss is negligible. As a rule the corona arcs do not have enough actual heat concentration to burn the material, but the formation of ozone causes oxidation of organic substances such as paper or other fabric and also all bonds of impregnations.

High-voltage alternating-current generators are subject to corona around the armature windings as soon as 4,000 or 5,000 volts exist between conductors and iron or ground, appreciable effects being found between the iron and solid insulation on the coils. The corona here is merely due to the breakdown or ionization of the air in the small space between the iron and the coil and has the appearance of small arcs shooting off the ends of small projections on the iron. The type of insulation used for this application involves mica flakes pasted or bonded to paper with some insulating varnish. A sheet of this is wound round and round the conductors to the desired thickness and then made to adhere or form a solid mass by applying heat and pressure. So far the mica has withstood the corona, not even the first layer of mica being affected, although each individual corona arc may have eaten away all of the organic material directly in its path on the outside.

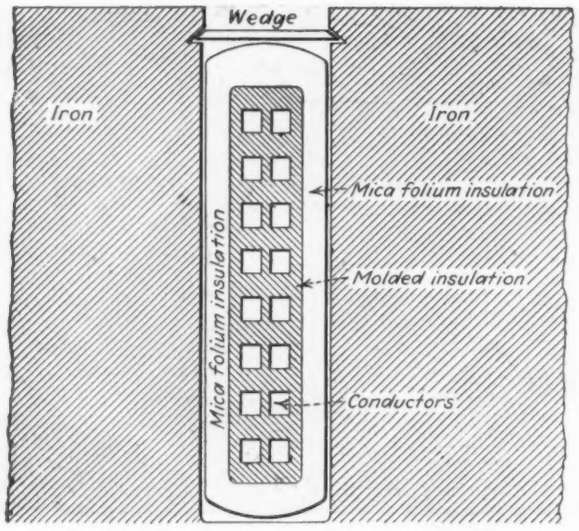
The tendency toward higher generated voltages has made it seem desirable to try to eliminate or prevent the formation of corona and a device has been developed for the purpose. In the set-up shown in the accompanying illustration 30,000 volts was applied between conductor and the iron plate in *A*, producing a heavy corona. To remove this it is necessary to bring the potential of the iron to the surface of the insulation. This was done by painting the coil with a conducting paint, the conducting layer being connected to the iron. This layer extends to the end of the slot and shields the air gap from any stress up to that point, but, as shown, at the end of the layer corona continues to occur.

The shielding effect is demonstrated at *B*, the corona occurring at the end of the shielding layer being removed by gradually lowering the voltage along a high resistance extension beyond the end of the slot. The current flowing into this extension to charge the capacitor between the extension and the copper conductors, while very small, is sufficient to produce a large voltage drop if the resistance is large enough. With resistances of several hundred megohms per inch length of coil, 30,000 volts may be damped out in a 4-in. or 5-in. extension. The complete assembly is shown at *C*.

The shielding layer should be grounded at many points to be at all practical and therefore a resistance of the layer must be used high enough to prevent short circuiting of the iron. Tinfoil, for example, has a resistance too low to ground at more than one point. The upper and lower limits of the resistance per inch of coil of this shielding layer, as determined by calculation, are from




*Test reveals corona-suppressive qualities of new method*




*Detail of micafolium insulation*

about 500 ohms to a few millions. The range is wide and it was first thought possible that a very poor dielectric would satisfy conditions, but actually it was found easier to produce a layer with resistance near the lower limit of 500 to 2,000 ohms per inch of coil. Such a device can be grounded continuously throughout the slot if desired. The special graphitic paint used for this purpose adheres closely to the solid insulation and forms a continuous film.

# Standardized Lighting for Large Industrial Buildings

"TODAY it is neither expensive nor difficult to provide a general system of overhead lighting in a factory substantially equal in illuminating value to the daylight which is obtained in the outside bays during the middle hours of the day," said Ward Harrison, director of illuminating engineering National Lamp Works, Cleveland, at the recent annual meeting of the American Society of Mechanical Engineers. "For industries in which such natural lighting is found to be entirely satisfactory for the outside bays the installation of a uniform system of overhead lighting will meet all the requirements of the central bays and also the requirements of the outside bays at times when daylight is inadequate. Such a lighting system may be installed at the time the building is constructed and should, in fact, be considered a part of the building itself, just as the plumbing and heating equipment are so considered.

"In designing the lighting system a considerable ultimate economy will usually be effected if a certain factor of safety is provided in the wiring. That is, the copper is made heavy enough to carry a lighting load of approximately 4 watts per square foot, even though the immediate requirements for light may not be for more than one-half of this amount. Obviously, also, the outlets should be spaced close enough together to provide reasonably uniform illumination over the working surface. This cannot be done by spacing outlets on 20-ft. centers with any ordinary ceiling height. With a 20-ft. spacing and lighting units 10 ft. above the floor (about 7½ ft. above the work) the variation in illumination between points directly under a lamp and those half way between lamps is of the order of 4 to 1."

The proper spacing of outlets for various ceiling heights is shown in Table I, and Table II shows the wattage allowance per outlet to be used in figuring the wiring for these various spacings. Table III gives the necessary wire sizes in order that the energy may be delivered to the outlets without causing a potential drop of more than two volts between the panelboard and the socket.

*Table I—Spacing of Outlets*

| Ceiling Height (or Height in the Clear), Ft. | Spacing Between Outlets | | Spacing Between Outside Outlets and Wall | | Approximate Area per Outlet (at Usual Spacings), Sq.Ft. |
|---|---|---|---|---|---|
| | Usual, Ft. | Maximum (for Units at Ceiling), Ft., Not More Than | Aisles or Storage Next to Wall | Desks, Work Benches Etc., Against Wall, Not More Than | |
| 8 | 7 | 7½ | | 3 | 50– 60 |
| 9 | 8 | 8 | Usually | 3 | 60– 70 |
| 10 | 9 | 9 | | 3½ | 70– 85 |
| 11 | 10 | 10½ | one- | 3½ | 85–100 |
| 12 | 10–12 | 12 | | 3½– 4 | 100–150 |
| 13 | 10–12 | 13 | half | 3½– 4½ | 100–150 |
| 14 | 10–13 | 15 | | 4 – 5 | 100–170 |
| 15 | 10–13 | 17 | actual | 4 – 5 | 100–170 |
| 16 | 10–13 | 19 | | 4 – 6 | 100–170 |
| 18 | 10–20 | 21 | spacing | 4 – 6 | 100–400 |
| 20 | 18–24 | 24 | | 5 – 7 | 300–500 |
| 22 | 20–25 | 27 | between | 5 – 7 | 400–600 |
| 24 | 20–30 | 30 | | 6 – 8 | 400–900 |
| 26 | 25–30 | 33 | units | 8 – 9 | 600–900 |
| 30 and up | 25–30 | 40 | | 8 –10 | 600–900 |

*Table II—Wattage Allowance per Outlet for Various Spacings*

| Actual Floor Area per Outlet, Sq.Ft. | Wattage Capacity per Outlet | | |
|---|---|---|---|
| | Class A Installations (Offices, Drafting Rooms, Factories, Etc.) | Class B Installations (Less Important Areas) | Class C Installations (Storage Areas) |
| 65– 75 | 300 | 200 | 150 |
| 75– 85 | 300 | 250 | 150 |
| 85– 95 | 350 | 250 | 200 |
| 95–110 | 400 | 300 | 200 |
| 110–125 | 450 | 350 | 250 |
| 125–140 | 500 | 400 | 250 |
| 140–160 | 600 | 450 | 300 |
| 160–190 | 700 | 500 | 350 |
| 190–220 | 800 | 600 | 400 |
| 220–260 | 950 | 700 | 450 |
| 260–300 | 1,100 | 800 | 550 |
| 300–340 | 1,250 | 950 | 650 |
| 340–390 | 1,450 | 1,100 | 750 |
| 390–440 | 1,650 | 1,250 | 850 |
| 440–500 | ..... | 1,400 | 950 |
| 500–560 | ..... | 1,600 | 1,050 |
| 560–630 | ..... | 1,800 | 1,200 |
| 630–710 | ..... | ..... | 1,350 |
| 710–800 | ..... | ..... | 1,500 |
| 800–900 | ..... | ..... | 1,700 |

*Table III—Wire Size Required*

(The length of wire for a circuit is double the length of run.)

| Length of Run (Panel Box to Outlet), Ft. | Watts per Circuit | | | | | | |
|---|---|---|---|---|---|---|---|
| | 800 to 1,000 | 1,000 to 1,200 | 1,200 to 1,500 | 1,500 to 1,800 | 1,800 to 2,200 | 2,200 to 2,600 | 2,600 to 3,000 |
| 30 or less | 14 | 14 | 14 | 12 | 12 | 10 | 10 |
| 30 to 45 | 14 | 12 | 12 | 10 | 10 | 10 | 8 |
| 45 to 60 | 12 | 12 | 12 | 10 | 8 | 8 | 8 |
| 60 to 80 | 12 | 10 | 10 | 8 | 8 | 6 | 6 |
| 80 to 100 | 10 | 10 | 8 | 8 | 6 | .. | .. |
| 100 to 120 | 10 | 8 | 8 | 6 | .. | .. | .. |
| 120 to 150 | 8 | 8 | 6 | .. | .. | .. | .. |
| 150 to 200 | 8 | 6 | .. | .. | .. | .. | .. |

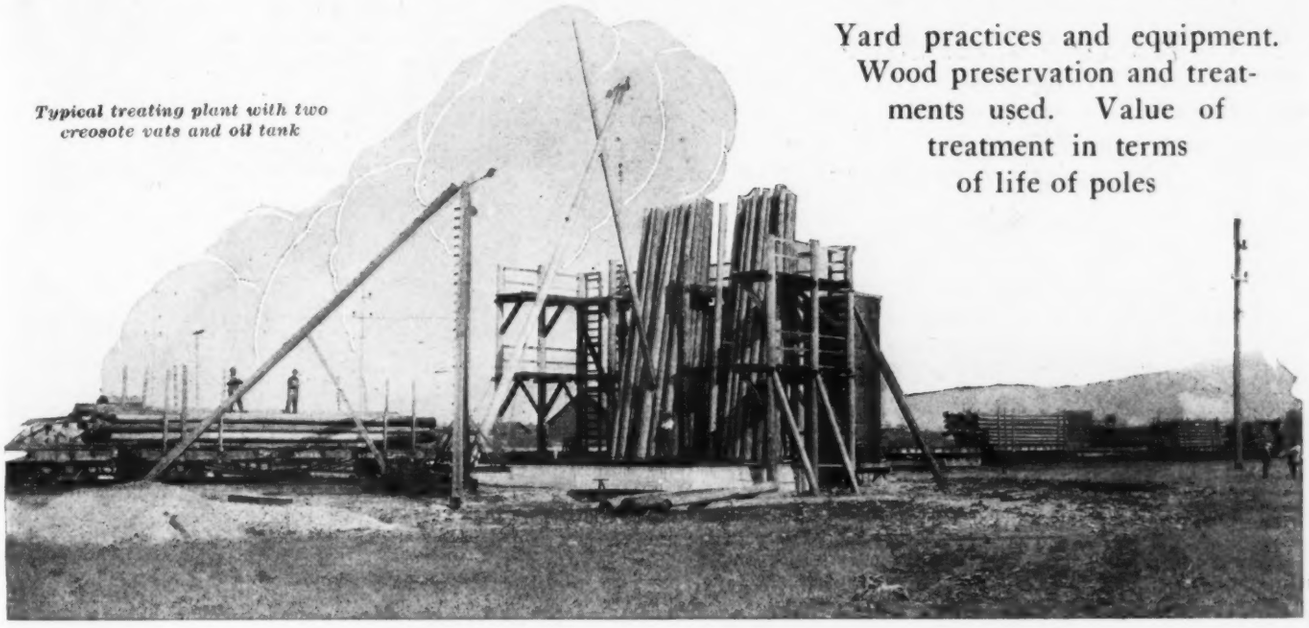
Note: This table shows the wire size required for 115-volt circuits of various lengths of run, based on a drop of two volts between the panelboard and the outlets.

It is difficult in branch circuits, at least with present wiring methods, to use larger than No. 8 wire because of the difficulty of handling in conduit. Where the proper wire size for a proposed installation, according to this table, is larger than No. 8, it is usually best either to provide more circuits with less load, or to relocate distribution centers to decrease lengths of run. The dotted line shows the usual practical limits for circuit load and length of run.

These recommendations on wiring are based on the allowances of the National Code: i.e., circuits equipped with medium screw sockets limited to 15 amp. and not more than twelve outlets per circuit. mogul sockets—limited to 40 amp. and eight outlets per circuit. Present wiring practice is usually well within the limit allowed by the code. In some cases it is necessary to meet other requirements of local codes.

# Western Red Cedar Poles

**Yard practices and equipment. Wood preservation and treatments used. Value of treatment in terms of life of poles**



*Typical treating plant with two creosote vats and oil tank*

IN MINNEAPOLIS and vicinity there is centered a large number of Western red cedar pole yards. The companies' yards represent an investment of more than $6,000,000, where incoming poles from the West are handled in transit to markets. These yards are used for seasoning, treating and sorting the poles and act as a customer storage reservoir for shipments to Middle West and Eastern markets. The stocks in storage are untreated poles and an attempt is made to maintain a fairly constant number of poles of each grade and size. A large stock is constantly held for prompt deliveries.

Poles arrive at the yards in carload lots and are unloaded onto skids in the yards. In some cases the car braces are cut and the poles are allowed to drop to the skidways; in other cases wire cable slings are thrown about the loaded car to ease the poles down to the skidways, and in still other cases booms and slings with bare or cushioned metal cables unload the poles from the cars. Methods differ and each method has its advocates. The poles are sorted in the yards, inspected for grade and are piled ready for treatment.

### Cedar Pole Preservation

Weathering of wood is the normal effect of winds, moisture absorption, evaporation and bleaching under seasonal weather conditions, whereby the fibers on the exterior swell and shrink alternately. This has no bad effect on a pole. But rot of wood is the result of an attack by wood-destroying fungi and may be very destructive. Rot may be found in a living tree where fungi have entered and this rot usually appears as heart or butt rot. It may or may not cease its growth when a tree is cut. Whether it affects the usefulness of the tree as a pole is decided by an experienced inspector.

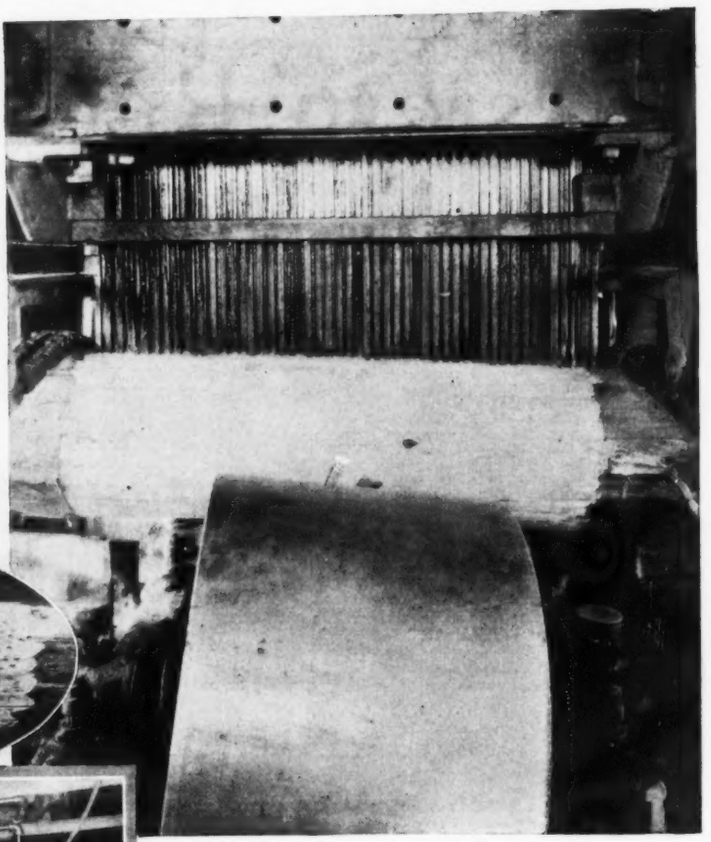
Other rots may occur when a pole is in storage for a long period. This is prevented by having yards sanitary and free of vegetation and decayed wood and poles piled so high on skids that air circulates freely about them. The third period of rot occurs when a pole is in service.

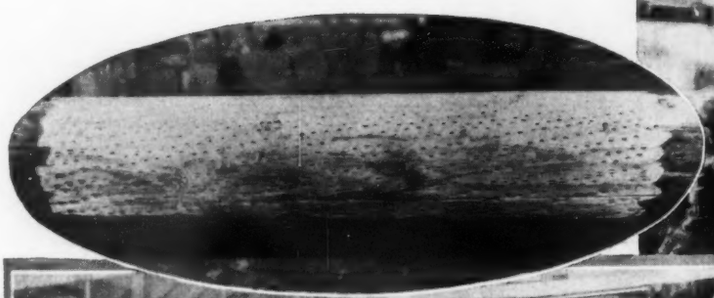
Wood can rot only when air, moisture, heat and food supply conditions sustain fungus growth. But these conditions often obtain at or near the ground line on utility lines, so that preservative treatments of wood poles have been developed as a means to prevent rot. The natural decay resistance of Western red cedar wood is so great that the customary preservative treatments are applied at the ground line area only unless special conditions are encountered. It is the usual practice to treat only the sapwood area from the bottom of the pole to a distance of about 2 ft. above the ground line and the depth of penetration of creosote, which is the preservative used for the vast majority of poles, is specified as $\frac{3}{8}$ in. or $\frac{1}{2}$ in. at the ground line area, depending upon the purchaser's desires.

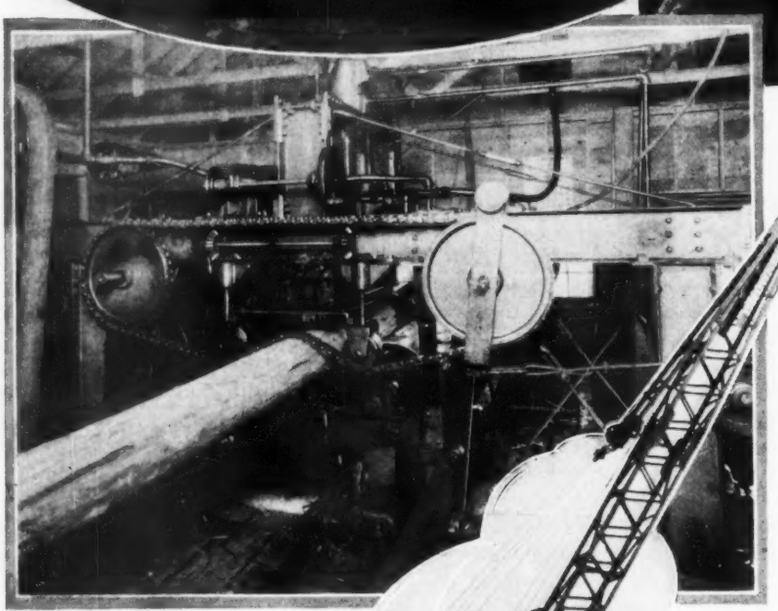
Although much scientific study has been made of wood preservation, both as regards the nature of the fungi and the toxic effects of preservatives, there is still a vast amount to be done. But many years of experience has indicated that creosote can be used successfully for wood preservation. Cedar wood when dry is about 75 per cent air and the creosote replaces air in the cell cavities and intercellular spaces of the sapwood, and in addition is naturally highly resistant to decay which prevents fungus growths. The creosote penetrates cedar cells more readily longitudinally. Some mechanical preparation of the ground line area is used to secure penetration in other directions as an economic and practicable part of the treating operation.

The modern treatment of Western red cedar consists in getting a seasoned pole with a bark free and clean butt and ground line area. In some cases the pole is shaved or planed for about 1 ft. above and 2 ft. below the ground line to remove bits of bark or a surface glaze of sap that might be present. This area is then prepared for treatment by using any one of several specially designed machines, or belts or hammers to get incisions made in the wood. Sharp steel points of different shapes make $\frac{3}{8}$ in. to $\frac{1}{2}$ in. penetrations of several

# *Perforation an Essential Step in Treating Processes*





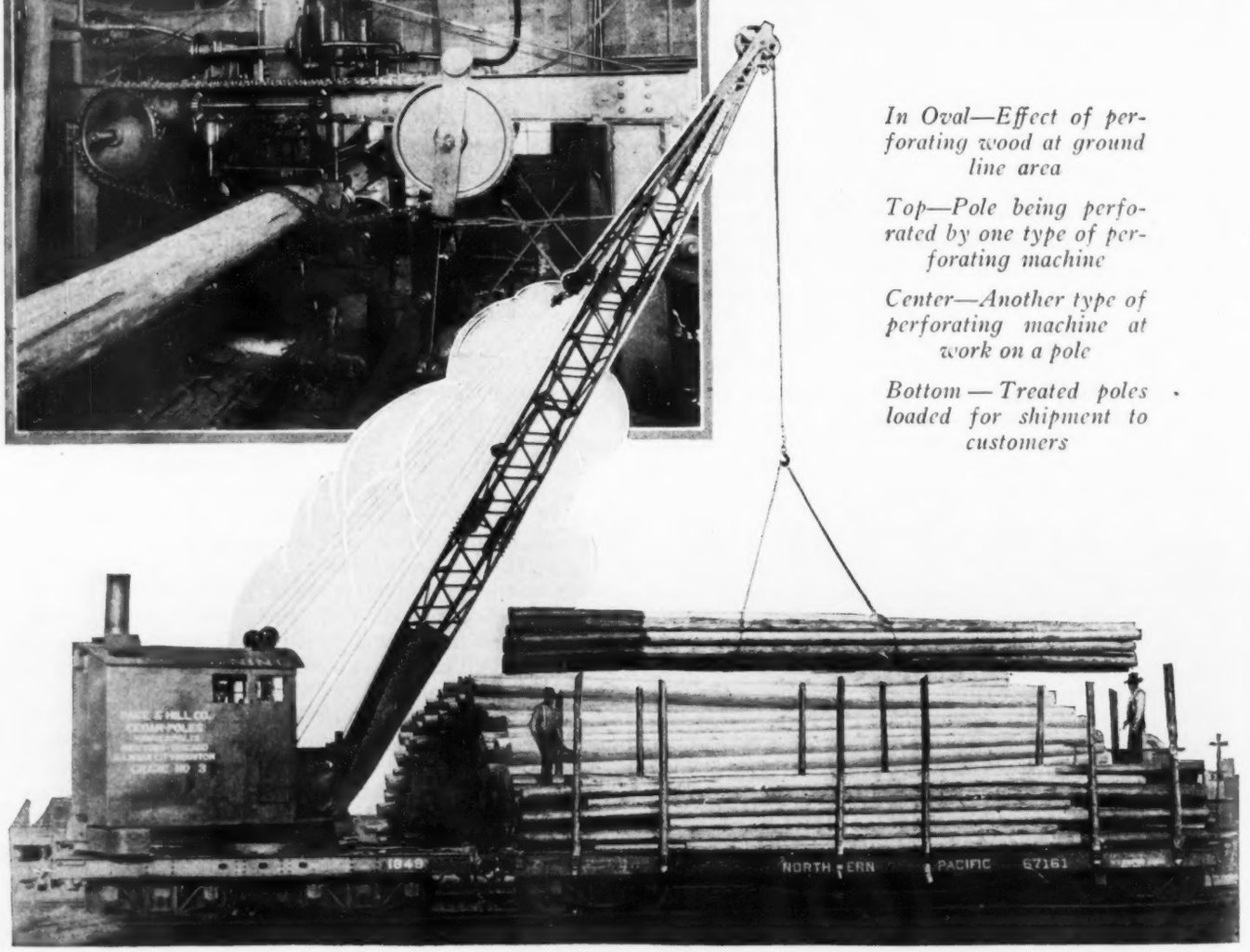


*In Oval—Effect of perforating wood at ground line area*

*Top—Pole being perforated by one type of perforating machine*

*Center—Another type of perforating machine at work on a pole*

*Bottom — Treated poles loaded for shipment to customers*

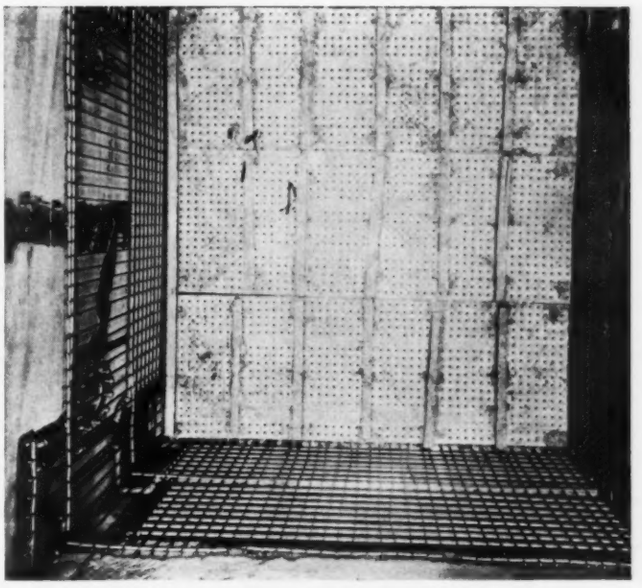


patterns in the wood area. About ½ in. circumferential separation and ¾ in. longitudinal separation of the incisions are commonly encountered. These incisions are made to insure uniform and rapid creosote penetration of the sapwood at the time that the poles are placed in the vats for treatment.

Many types of power-driven incising machines are used; each has a following and each has claimed advantages over other types. Arguments are made pro and con as to effects on strength produced by cutting or not cutting fibers, opening large or small holes, getting uniform depth of incisions independently of knots and uneven surfaces and other differences in poles, but observations in the several yards lead to the conclusion that these are minor considerations as compared to the fact that the penetration desired can be obtained by use of any of the machines.

After the ground line area of the poles is incised to a desired depth and pattern by the knives in the machines the poles are lifted into treating vats. The vats vary from one-half to two carloads in capacity. A power winch stationary boom, or locomotive crane, places the poles in the vats with butts down and hot creosote oil is then put into the vat to the height desired. The poles receive a hot oil treatment, with the temperatures of the oil held below 230 deg. and above 210 deg. for a minimum of six hours, or until the desired depth of penetration is reached. After this hot treatment the oil either is left in the vat to cool down or it is drawn off and cold oil is put into the vat immediately so that the poles cool off, so to speak, for three to four hours in oil at a temperature of from 150 to 100 deg. The poles are then removed from the vat, inspected and loaded for shipping. Inspection of the treatment is had by making borings in the treated area. In some cases only one boring is made, but in other instances two or three borings are made in each pole.

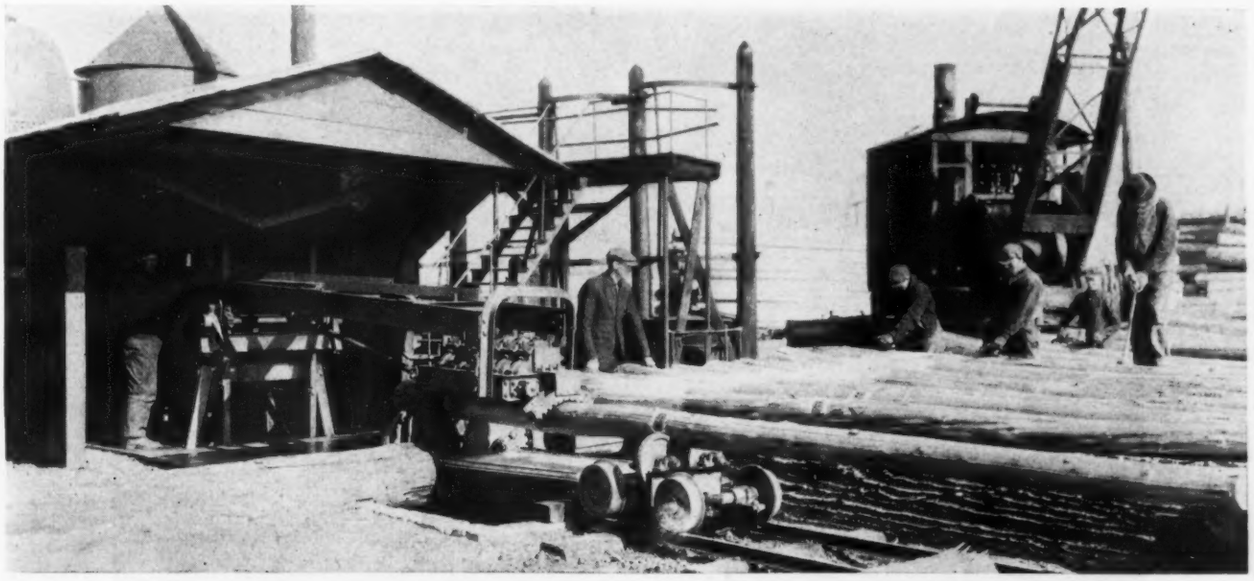
Preservative open tank treatment of cedar with creosote requires less technical equipment than does pressure treatment. A temperature in excess of 250 deg. F. is not desirable, since it may in a few hours, if the moisture content is low, injure the wood by charring. Proper preparation of the area to be treated by shaving is practised to get uniform penetration. The duration of the



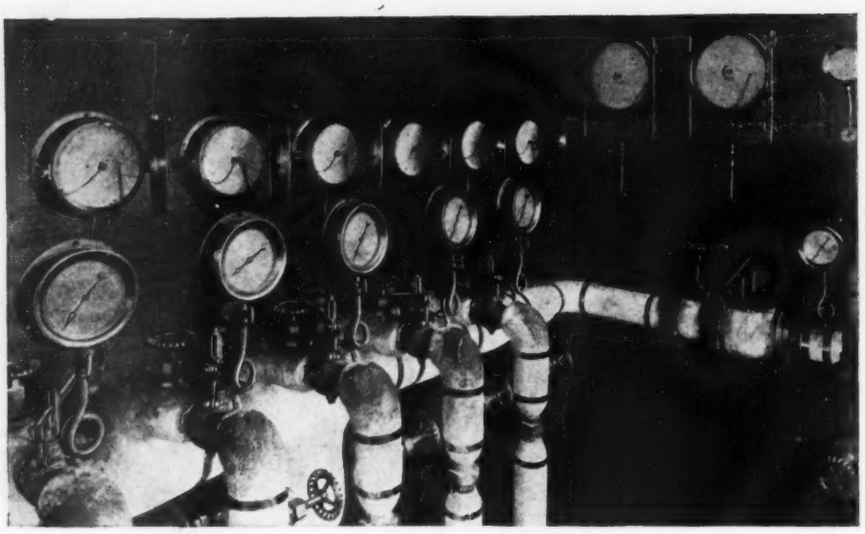
*Looking down into a treating vat*
High-pressure steam coils are used on sides and at bottom

hot treatment varies somewhat with the conditions of the cedar used as to weathering and seasoning when placed in the treating vat. Inspection after treatment is good practice because cedar poles differ and borings make it possible to examine and to insure proper penetration in all poles. Domestic creosote oil is favored and it is purchased on AWPA specifications. Usually a gravity of about 1.03 and 1.08 and a minimum amount of paraffine are favored characteristics of the oil. Some companies make their own laboratory analysis of the oil, some go to commercial chemists, while some rely upon the analysis of reputable creosote oil companies.

The economic value of preservation of the sapwood in the ground area is well established. If the ground line sapwood is preserved the pole strength is retained over a much longer period and the total life of the pole is increased. The penetration or incision method of treatment is only a few years old and exact data on added life are not available, since life data based on old installa-



*Preparing ground line area of poles by planing and machine for making incisions in the wood*



*Steam mains and recording instruments on treating vat*

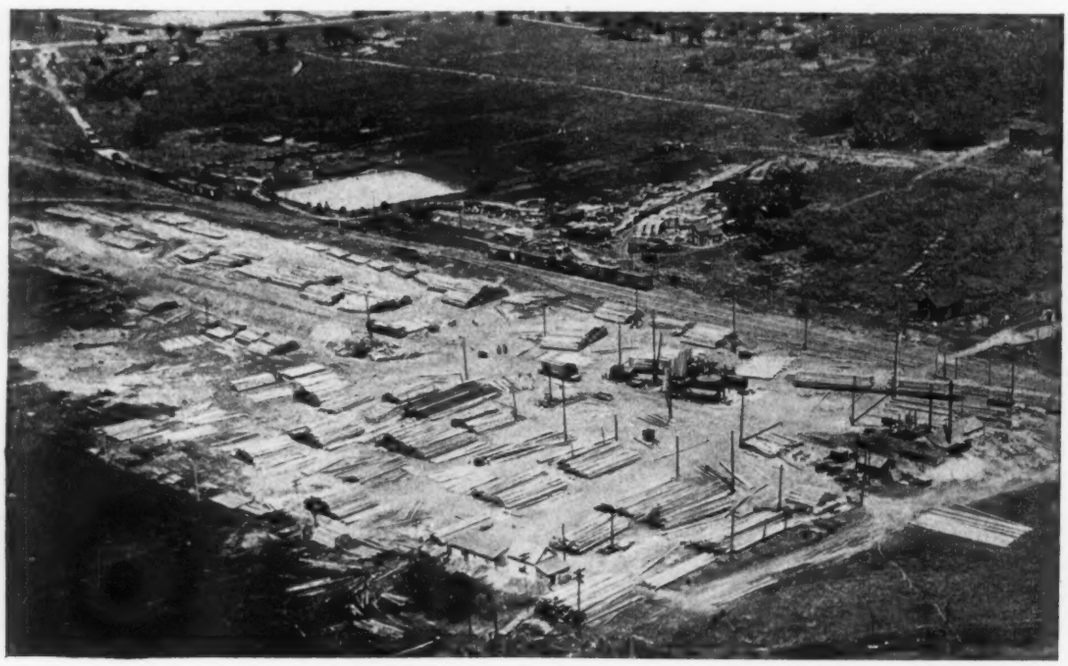
tions with "AA" or "B" treatments cannot be applied. Researches indicate that creosote leaches out or disappears from the sapwood at the rate of about 1 lb. per cubic foot of sapwood per year and that about 6 lb. per cubic foot of the original creosote is sufficiently toxic to prevent fungus growth. This means that the treated wood with about 33 lb. of creosote per cubic foot of sapwood has conservatively an added life of about 25 years because of the treatment, and with an assumed average minimum figure of five years for the sapwood life of an untreated cedar pole it would seem reasonable to assume that a properly butt-treated cedar pole could be counted upon conservatively for a minimum of at least 30 years of service in line design calculations, even though accounting practice might give it a capital investment life of about fifteen years. The cost of treated and untreated poles may be had for each condition of purchase and the economic value of treatment as compared to its cost should justify treatment of all poles used on lines built for long-term service. Some purchasers use a $\frac{3}{8}$-in. specification because they believe this will give an economic life for the poles, especially as many poles will get full sapwood penetration because of the differences in the capillary action in different cedar poles, but others believe a full $\frac{1}{2}$-in. penetration is justified on a cost basis.

Most of the larger pole companies have their own producing and treating facilities, but some commercial treating plants are available where either pole producers or pole purchasers may have their poles treated. The amount of business handled in this manner is small as compared with the business done by larger pole companies.

Pole yards in the vicinity of Minneapolis are of various sizes and their equipment varies. In some cases the pole company handles Northern white cedar and railroad ties and fence posts in addition to Western red cedar. In nearly all yards the skidways are of cedar wood and are movable. A general endeavor is made to keep all vegetation out of the yards and to pile the poles on skids at least 2 ft. above the ground. Teams of horses, local booms and locomotive cranes are equipments used in the yards for handling the poles. Inspection is done carefully and includes butt measurements, top measurements, length, twist, sweep, defect, etc. Very few defective poles arrive at Minneapolis because the inspection system in the wood is very efficient.

The treating plants are usually composed of a boiler house to produce steam, open tanks or vats for treating poles, oil tanks and pumps and a covered house for the incising machine. Vat design is a special feature of each yard, but live steam for heating and temperature indication with recording thermometers are common practices. The inventory of poles is quite large at all yards for prompt shipment is a competitive asset in the pole business.

A third article in this series will deal with commercial aspects of the business, users' experiences with cedar poles and conclusions in regard to the industry.



*Airplane view of a Minneapolis transfer and treating yard*

# Factors that Affect Rates*

Fixed charges and generating costs segregated and use factors pointed out in an evaluation of service costs. Commercial elements important

By N. M. ARGABRITE
*Vice-President American Gas & Electric Company*

IT IS a very common thing to hear a customer use the catch expression that he is willing to pay for what he uses, but that he does not want to pay for anything he does not use. We cannot blame him for that. The trouble is not a question of unfairness on the part of the customer. The question is the customer's education as to what he is using.

The first thing for consideration in preparing to serve a customer is to provide a plant with which to do so. We have to provide transmission, distribution, transformation and meter facilities, office buildings, warehouses, rolling stock, tools and all the paraphernalia necessary completely to equip a going concern. When this plant is set up, we find we have to pay taxes on that plant, and when we speak of "plant" in this instance we mean the entire equipment which is used for the customer's service from beginning to end. We have to pay for the use of the money invested; we have to take care of depreciation and insurance—all of which must be paid for whether one kilowatt-hour is sold from that plant or a million. There are quite a number of other charges that go on regardless of the kilowatt-hours coming out of the plant, and others that are only slightly affected by the number of kilowatt-hours generated. Allowing for the different elements of investment, such as plant transmission, transformation, distribution, office buildings, etc., you will find as a general average about $360 of investment against every kilowatt of capacity that the company is in position to sell. We do not mean that we shall find $360 per kilowatt of capacity in the plant, because some of that capacity is not useful and must be kept in reserve for breakdown insurance and other capacity kept for growth, but we refer to that capacity which you will find in use on the average system and which the utility can afford to sell. This capacity over-all will run somewhere around $360 per kilowatt of salable capacity.

The first consideration in providing for the sale of one of these kilowatts of capacity is the item of fixed charges, already referred to, and it will take somewhere above 10 per cent of the value of the property to cover these elements of interest, depreciation, taxes, etc.; in other words, against every kilowatt of capacity that we are going to sell we must get $36 a year before any energy is delivered from that plant. After this we have to reckon with the manufacturing cost of the kilowatt-hours. This question of manufacturing cost may be anything from 3 or 4 mills up to 1 cent or more, depending upon load factor, location, freight rates, plant economies, etc., but in order to have a figure to work with and which would fit in with some of the large plants supplying a very mixed load, let us assume 4 mills to be the manufacturing cost. This 4 mills, of course, is not intended to cover such things as taxes or service rendered by men outside the plant; it is simply used in this instance to cover the cost of manufacturing and delivering energy on the switchboard.

Now we have the two principal factors which have to be reckoned with in a demand and energy charge: (1) $36 per kilowatt of capacity a year; (2) 4 mills per kilowatt-hour generated. Let us see what this will amount to for a user consuming 1 kw. for one hour each day. One hour a day every day in the year would make a consumption of 365 kw.-hr., and 365 kw.-hr. divided into $36 a year would give a demand charge against each one of these kilowatt-hours of approximately 9.6 cents. To this demand charge per kilowatt-hour must be added the energy cost or the cost of manufacturing each one of these kilowatt-hours. This is, as stated before, 4 mills per kilowatt-hour, so that these two elements of rate building alone give us a very astounding split of 9.6 cents to get ready to serve and 4 mills actually to serve a one-hour-a-day user.

It thus costs the utility 10 cents per kilowatt-hour to produce the energy and to carry the fixed charges on a customer use of one hour daily of 1 kw. of capacity. If the use is increased to two hours a day, the cost to the utility to carry these two elements is about 5½ cents per kilowatt-hour. If the use is increased to ten hours a day, it costs the utility for these two elements 1½ cents per kilowatt-hour, and if the use is 100 per cent, running twenty-four hours a day, it then costs the utility to carry on and produce 8 mills per kilowatt-hour. You will note that with 100 per cent load factor the cost of manufacturing and the cost of carrying, in the example cited, is half and half, or the two elements are an offset against each other. As you leave the 100 per cent load factor condition and go toward the lower percentages every step widens the gap between these two elements and the ready-to-serve portion of the cost to the utility grows.

### COST PER KILOWATT-HOUR MEANINGLESS AS SUCH

There is nothing complicated about this. It is simple arithmetic and you cannot get away from it. Your carrying charges, your depreciation, your taxes—all of these elements go merrily on whether the equipment is used one hour a day or twenty-four hours a day, and I think this will show you how perfectly ridiculous it is for any one to talk about costs per kilowatt-hour without having other factors available. The cost per kilowatt-hour means absolutely nothing; unless you have some of the other elements that go into the delivery of electric service you cannot under any consideration give a cost per kilowatt-hour covering that service.

If we could just get away from the habit we have of

**Excerpts from an address by Mr. Argabrite at a recent meeting of the Public Utilities Association of Virginia.*

talking about the cost of kilowatt-hours and could find some way to convert that to kilowatt-year we would be getting nearer to the correct basis of the measurement of electric service, and if we could get away from the notion that we are selling electric energy and convert our own minds and the minds of the public to the fact that we are selling electric service, we would break down very materially some of the misleading impressions that are running loose throughout the land.

Another element in rate building is what we might call a "per customer" cost. If you will take the operating sheet of an ordinary public utility you will find the classifications of accounts divided into distribution, utilization, commercial, new business, general, general maintenance, transmission and production expenses and taxes, etc. Some of these expenses follow most closely in ratio with the number of kilowatt-hours produced; others follow most closely the fixed charge element, and still others seem to run in the ratio of the number of customers, and it is this last class that we want to treat of at this time.

In order to arrive at some conclusion as to what these apparent per customer costs amount to, we have had a number of central-station systems analyzed. Some of them run very high and some of them very moderate, depending to some extent upon the size of the community and to a greater extent upon the type of the community. If it is a compact and dense, urban community the per customer cost is likely to run comparatively low. If, however, the community served has a large outlying district, where the lines are long, travel of the various men maintaining the service is excessive, number of miles to keep up per customer is large, then, in that case, the per customer cost is bound to be much higher, even with communities of comparatively the same population.

### Population Density an Important Factor

We have analyzed and compared two communities, each serving a population of between 40,000 and 50,000 people. In the one where the population was dense these apparent per customer costs run about $21.60 a year. In the community where the customers are spread over a large area the per customer costs amounted to $22.12 per customer per year. Further investigation told us that a very large number of communities would analyze in the neighborhood of $33, and for the purpose of demonstration we are going to use this $33 element in building the comparisons we talked of a short time ago; that is, building the cost of serving 1 kw. for one hour a day and 1 kw. for twenty-four hours a day, 1,000 kw. for one hour a day and 1,000 kw. for twenty-four hours a day to see where we arrive in estimating revenue values.

One kilowatt used one hour a day will have a demand charge of $36 a year and will have a per customer cost of $33 a year. We use 365 kw.-hr. at 4 mills, or $1.46, for the energy; adding these together we get $70.46 for the cost of supplying the 1 kw. for one hour a day for the year. Dividing this $70.46 by 365 kw.-hr., we arrive at a per kilowatt-hour cost of 19.3 cents per kilowatt-hour. Sounds rather high, doesn't it? Figure it out on your own property and see what it is costing you to provide this service.

Suppose a customer uses 1 kw. twenty-four hours a day. The demand charge will still be $36 a year, the per customer cost will still be $33 a year, the energy charge will be 8,760 kw.-hr., or $35.04, making a total of $104.04. Dividing this $104.04 by 8,760, we find that this energy costs the utility 1.18 cents per kilowatt-hour.

Take the 1,000-kw. customer using one hour a day and you will see in this calculation why a short-hour user with a big load is something that bears watching; 1,000 kw. of capacity at $36 a year is $36,000; one customer at $33 a year is $33 and 365,000 kw.-hr. at 4 mills will cost $1,460. Put these figures together and you have $37,493 as the cost for supplying this energy. Divide this $37,493 by 365,000 kw.-hr. and you find that this energy costs the producer 10.03 cents a kilowatt-hour to produce and deliver. Look out for the one-hour user!

### Consumption and Hours of Use Important

Now take the user who consumes 1,000 kw. every day of the year for every hour of the day; 1,000 kw. of capacity at $36 a year is $36,000; one customer at $33 a year is $33 and 8,760,000 kw.-hr. at 4 mills is $35,040; adding these together we arrive at the total of $71,073. Dividing $71,073 by 8,760,000 kw.-hr., we find that that energy costs the producer 0.81 cents. Note the difference. Same plant, same system, same everything, except the size of the customer and the load factor. The size of the customer going up from 1 kw. to 1,000 kw. actually reduces the cost to serve one hour a day from 19.3 cents per kilowatt-hour to 10.03 cents per kilowatt-hour. One customer uses twenty-four hours a day, giving a comparative cost of 1.18 cents per kilowatt-hour as compared with 0.81 cents per kilowatt hour.

We have used a factor of 4 mills to represent manufacturing cost. That is not fair because it actually penalizes the large user in favor of the small user. It is not fair because of the fact that the cost of manufacturing electric energy is affected very materially by load factor, and consequently if your public utility enjoys a comparatively low manufacturing cost, it is enjoying that low manufacturing cost really because of the fact that it has upon its system large load factor users of energy who keep the plant loaded practically during the entire twenty-four hours. Think what it would mean if all your users were short-hour users.

And now let me point out what you can do for your customers and what you can do for your utility, if you will put on an extra head of steam and convert them to the use of electric appliances, thus putting to use more hours a day those facilities which are already at their disposal and are used only a very short period of time during the twenty-four hours. Your opportunity is golden. The excess cost to your customer is trivial. You owe it to your customer, as well as to your utility, to load these facilities down and make them work. Idle money, whether it is owned by the city, nation, corporation or individual, is not doing any one any good and is a detriment to business. The answer is to load up your facilities with long-hour users.


## *Index Published Separately*

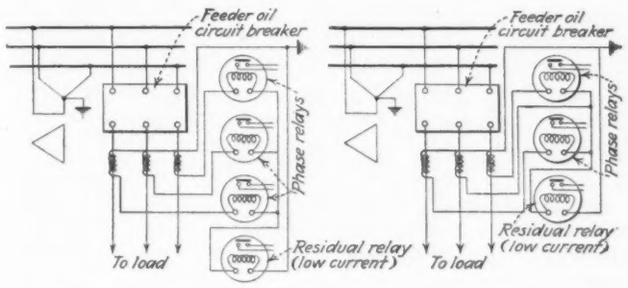
THE index to the June-December, 1928, issues of Electrical World will be published as a separate pamphlet with elaborate cross references. If you bind your copies send your name, company position and address to the Circulation Department, McGraw-Hill Publishing Company, Inc., Tenth Avenue at 36th Street, New York City, and an index will be sent to you.

# Three Relays Serve Purpose of Four in California Substations

By E. R. Stauffacher

*Electrical Protection Engineer*
*Southern California Edison Company, Los Angeles, Calif.*

THE practice of the Southern California Edison Company of using four relays to obtain phase and residual ground current protection on 11- to 16-kv. distribution service has given way to the use of three relays connected as shown in the accompanying illustration. The practice in the past has been to connect four




*Relay connections for phase-to-phase and phase-to-ground feeder protection*

Where the Southern California Edison Company formerly used four relays as shown in the left-hand diagram, the same protection is now secured by three relays connected as shown in the right-hand diagram.

relays as shown in the left-hand diagram, where feeders are supplied from transformers connected grounded Y or where a grounding transformer bank is used to establish a neutral. The connection shown in the right-hand diagram eliminates use of one phase relay, yet provides protection against phase-to-phase short circuits and phase to ground troubles. The phase relays are set at a heavy current and short time, while the residual relay is set at a low current value and a somewhat longer time.

Although the elimination of one of the relays results in a difference in impedance across the secondary of one of the current transformers as compared to the others, the difference is not of sufficient magnitude to cause trouble when the set-up is used for the protection of distribution feeders. Tests have shown that a slight current will flow through the residual relay if an extreme single phase unbalance develops on a feeder. The same tests showed, however, that the unbalance must be in excess of a ratio of 80 to 400 amp. before there is any possibility of incorrect relay operation. This unbalance is far in excess of any met with in practice and thus far there has been no faulty or unnecessary operation of relays using the modified and more economical scheme described.

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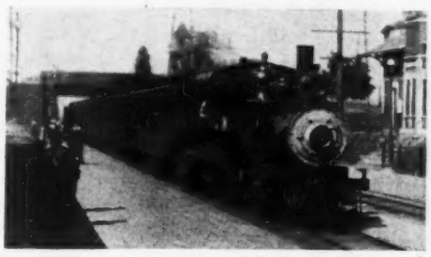
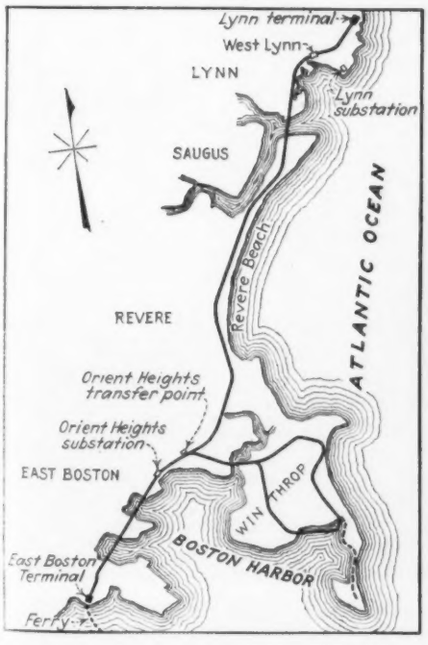
# Electrified Service Speeds "Narrow-Gage" Trains

TEN minutes has been cut from the 32-minute ferry and train running time between Boston and Lynn, Mass., by the electrification of the Boston, Revere Beach & Lynn Railroad at a cost of about $1,400,000 for the 34.5 miles of track. Sixty motor cars and seven trailers comprise the revenue-producing rolling stock. The road carried 13,350,000 passengers in 1927 and operated about 2,872,500 car-miles. Energy is supplied to multiple-unit trains at 600 volts direct-current taken from a catenary trolley system fed from the Boston Edison and Lynn Gas & Electric companies' systems through substations located at Orient Heights and West Lynn.

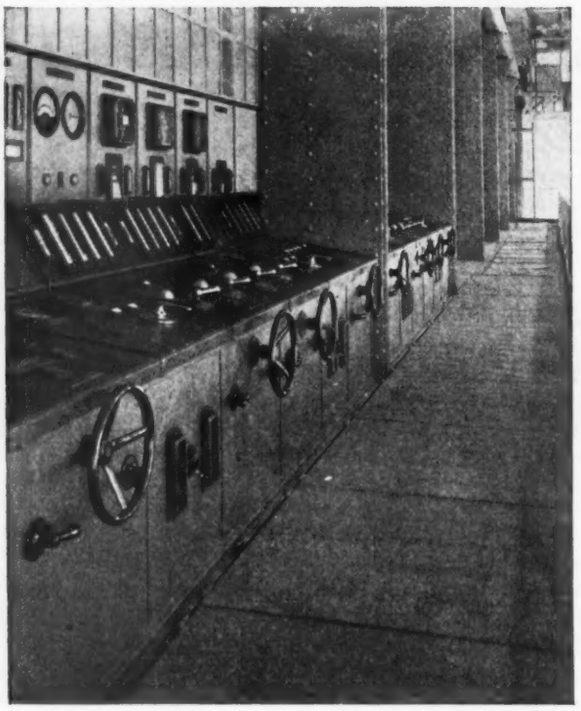
The estimated annual energy consumption of the road, including the Winthrop branch, in electrified operation is 10,000,000 kw.-hr., of which 75 per cent will be purchased from the Boston company and the balance from Lynn. The usual striking benefits of electrification are being realized throughout the densely populated suburban territory served by this 53-year old line.



*Before and after electrification*




*Route of electrified narrow-gage road*



*Switchboard and control desks in Rempen plant*

# High-Head

By E. GROB
*Electrical Planning Engineer*
*Kraftwerk Waeggithal, Ltd.*

THE outstanding features of the Waeggithal hydroelectric development in Switzerland are the high heads employed and the application of pumped storage on an extremely large scale, as used, for example, in the case of the Rocky River plant of the Connecticut Light & Power Company.

The development was constructed jointly by the city of Zürich and the Northeast Switzerland Power Company during the years 1922 to 1926. It consists of two power plants located on the same river, one above the other. The upper plant, Rempen, has the following equipment: four 16,500-kva. generators, unity power factor; four 16,000-kva. transformers, 8.8/50-kv.; four 5,000-kva. pump motors, unity power factor, which can be used as four 5,000-kva. synchronous motors, zero power factor, and four outgoing 50-kv. lines.

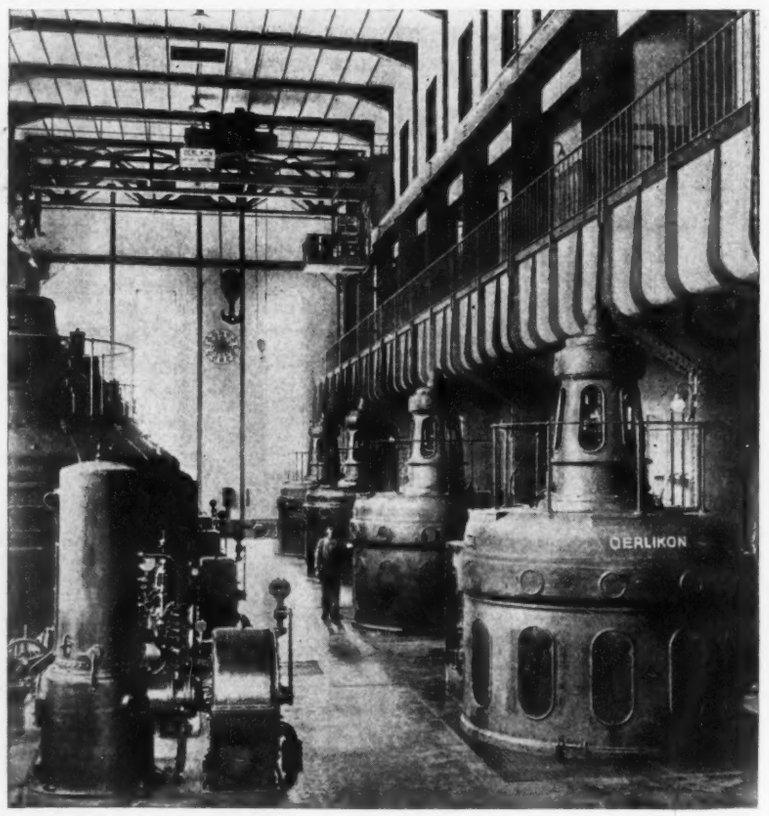
The lower plant, Siebnen, comprises four 16,500-kva. generators, 0.73 power factor; two 16,500-kva. transformers, 8.8/50-kv.; two 16,500-kva. transformers, 8.8/150-kv.; three 16,500-kva. transformers, 50/150-kv.; eighteen incoming and outgoing 50-kv. lines, and three (later five) outgoing 150-kv. lines.

The Waeggithal development is exclusively a peak power supply for supplementing the low-head power plants of the two co-operating power supply systems. It was designed to supply 110,000,000 kw.-hr., with a maximum power output of 114,000 kw., between Nov. 1 and March 31, a period of five months. In view of the fact that the supplying of energy is confined mostly to working hours on weekdays, the whole energy output can be considered as taking place within about 1,200 hours of operation.

During the summer months, from April 1 to Oct. 31, no energy is, theoretically, supplied. During this period the generators of the Siebnen plant act as phase compensators for the power systems of the two co-operating companies and can deliver, as such, 60,000 kva. at zero power factor, while in the Rempen plant the pump motors are used to pump the water collected in the intermediate watershed of the Rempen plant back into the upper reservoir, at night, by means of the surplus power. Both plants are, of course, available for emergency operation, to assist either one of the two co-operating companies in cases of service interruption or during the overhauling periods of other plants.

Some data as to the amount of energy produced, the maximum power output, the amount of storage water pumped, etc., are given in the accompanying table. Furthermore, since 1 cu.m. of pumped storage water produces 0.9 kw.-hr., the kilowatt-hours generated by this means are also given. During the years 1924 to 1926 construction work was still in progress; 1926-27 is the first normal year.

In the Rempen power plant the four single-wheel vertical Francis turbines, working on a head of 200 to




*Interior of Rempen plant*

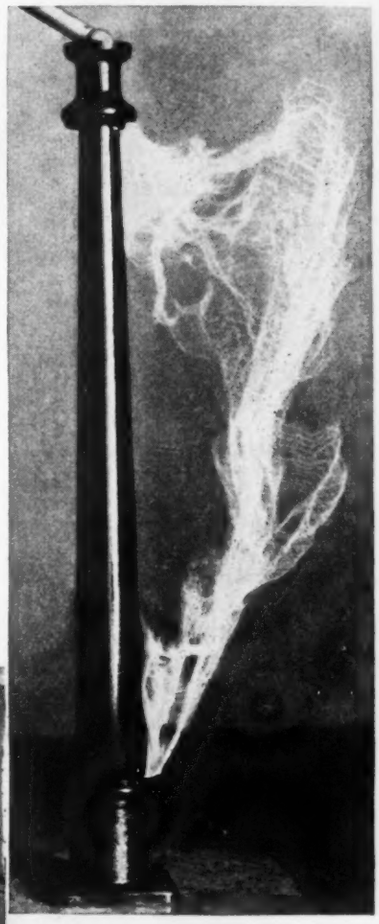
# Swiss Station

## Waeggithal hydro-electric development features high head and large-scale pumped storage. Two plants operated jointly. Description of design and details of construction

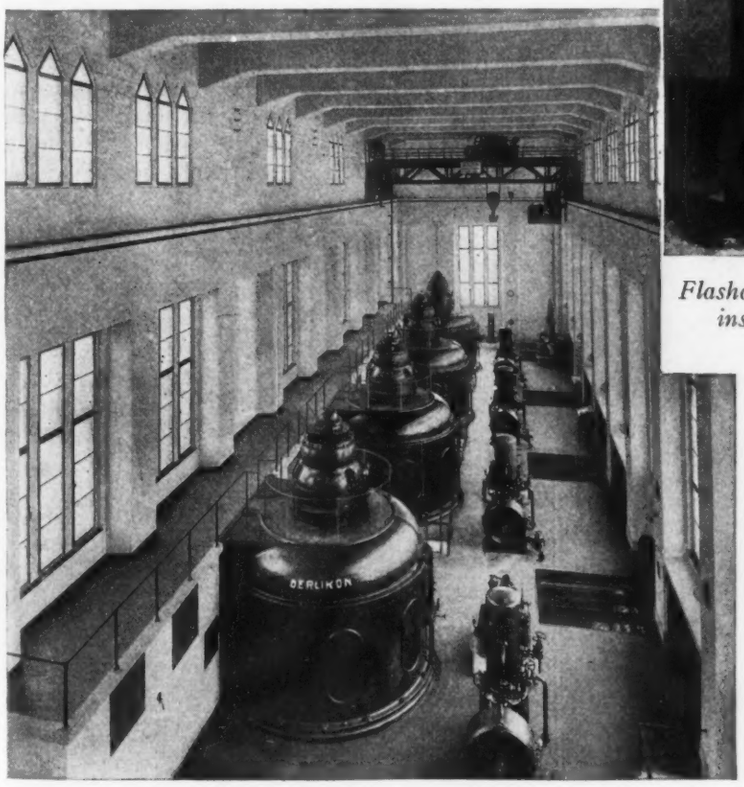
250 m., are directly coupled with four totally inclosed three-phase generators, with built-on exciters, each rated at 16,500 kva., unity power factor, 50 cycles, 500 r.p.m., for a line voltage of 8,800 ± 10 per cent.

The four transformers are of the standard three-phase oil-cooled type, with closed circuit oil cooling by means of two vertical tube coolers with water circulation. They are of the core type, rated at 16,500 kva. in delta-star connection, and have the high-tension neutral brought out. They are located in open recesses in the wall of the engine room directly opposite the generators. On the low-tension side they are fitted with taps for 8.8, 9.2 and 9.6 kv. at 50 kv. high tension. These taps are needed as the transformers are used during the summer for the supply of the summer load. By means of special interlocking devices the taps can be changed in a very short time. At a ratio of 9.7/55 kv. their continuous rating is 18,200 kva., 20,600 kva. for three hours and 22,300 kva. for one hour.

| Year | Kilowatt-Hours Generated | Maximum Kilowatts | Water Pumped in Cubic Meters | Kilowatt-Hours Generated by Pumped Water |
|---|---|---|---|---|
| 1924/25..... | 39,000,000 | ..... | 11,000,000 | 10,000,000 |
| 1925/26..... | 47,000,000 | ..... | 15,000,000 | 14,000,000 |
| 1926/27..... | 124,000,000 | 96,000 | 23,000,000 | 20,000,000 |
| 1927/28..... | 122,500,000 | 102,000 | 47,500,000 | 43,000,000 |



*Flashover at 420 kv. on wooden insulator used at 150 kv.*



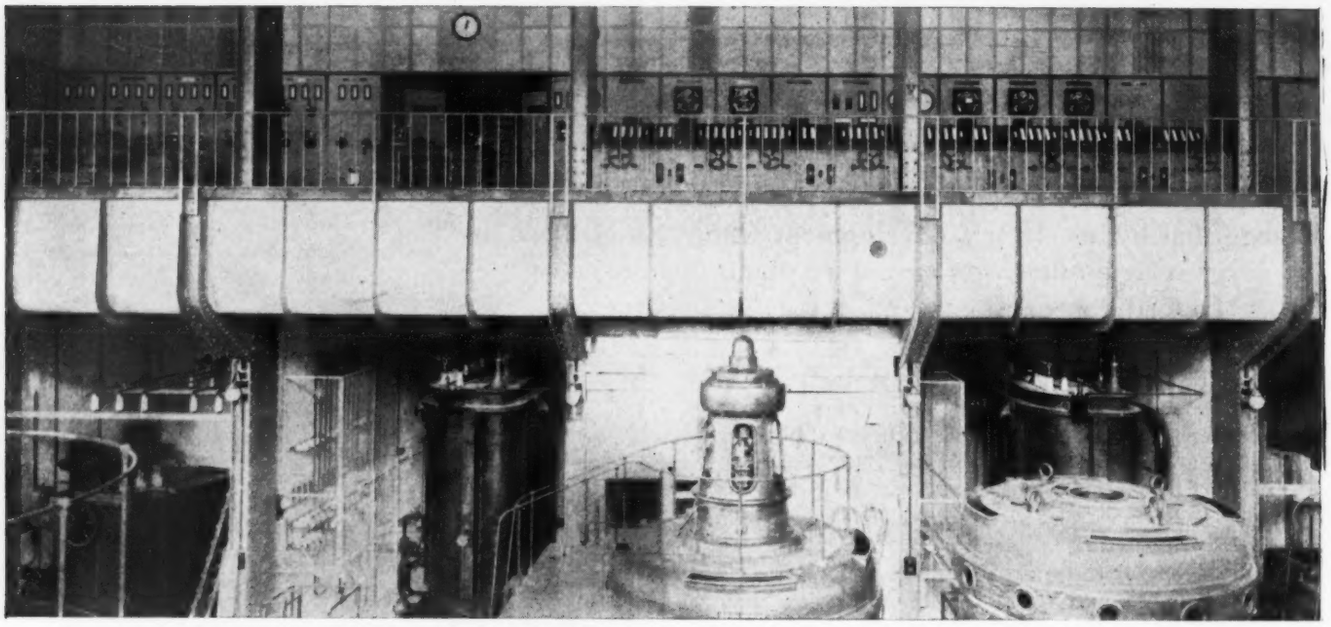

*Interior of Siebnen plant*

These overload capacities are necessary because, when the maximum power is required from the power plant, each generator has connected in parallel with it a pump motor, used as a phase compensator, whereby the output of each generator-motor-transformer group can be increased to 21,500 kva., at a power factor of 0.77.

The motors of the three-stage vertical centrifugal pumps, for a capacity of 1.1 to 1.65 cu.m. of water per second, are synchronous induction motors, with starting transformer, hot water starter and automatic synchronizing. By means of a slip regulator it is possible to decrease the normal speed of 750 r.p.m. by 10 per cent, in order to adjust it exactly to the pump characteristic under the variable pressure of 215 to 265 m. The output of the motors is 5,000 kva. at unity power factor when used as a motor and 5,000 kva. at zero power factor when used as a phase compensator.

An alternating-current temperature measuring device, which measures the temperature at five places in the generators, five in the motors and four in the transformers (in the windings, in the iron and in the oil, respectively), has an indicator in the control desk pertaining to each generator, so that the temperatures of the equipment can be supervised during periods of heavy loads. The thermocouples for the windings are in direct contact with the bare copper on the high-tension side. The indicator currents pass through insulating transformers to the bridge transformers.

In respect to regulation and protective equipment, only such equipment was provided



*Rempen plant looking toward switchboards, which are above the turbine room floor*

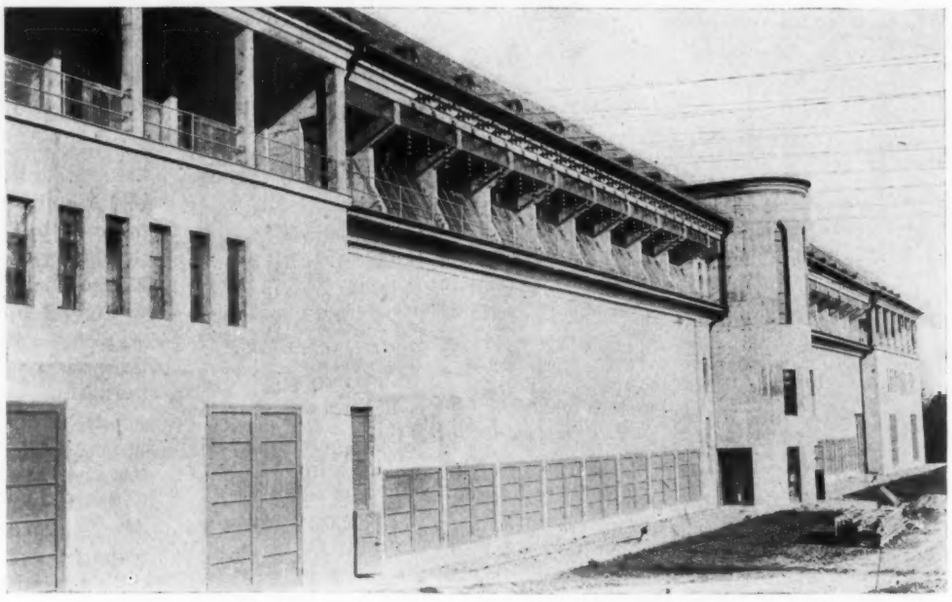
whose absolutely positive functioning was guaranteed in advance. These included a current-limiting regulator, a voltage regulator, a maximum time relay for the 50-kv. breakers, arranged to be released simultaneously for each generator set by the 8.8-kv. and the 50-kv. current transformers, and carbon dioxide fire-extinguishing equipment.

The current-limiting regulators are of the Brown-Boveri type and were called upon to operate quite frequently during severe thunder and snow storms. In no single case, even in the most severe short-circuit conditions, did the power station in question fall out of step with the network to which it was connected, nor did the generators fall out of synchronism. The current-limiting regulators are set for 1.4 times the normal current and the maximum time relay for 1.6 times the normal current and ten seconds. The voltage regulators are also of the Brown-Boveri type. The fire-extinguishing equipment for the carbon dioxide has never yet been called upon to function.

The switching and circuit breaker layout was kept as simple as possible, but with a relatively great electric safety factor. The following clearances are kept on the high-tension side: For 8.8 kv., phase to phase, 350 mm.; phase to ground, 240 mm.; length of disconnecting switch, 300 mm. For 50 kv., phase to phase, 900 mm.; phase to ground, 650 mm.; length of disconnecting switch, 700 mm.

The 50-kv. insulators are cast solid from synthetic resin and are 650 mm. high. The total distance between the arcing rings is 400 mm. In spite of the cast construction, the insulators are very elastic, and an insulator of this length, 650 mm., can be bent 40 mm. at one end without damage, the insulator springing back to its original shape after the pressure is released. Shocks up to 25 kg. are withstood without breakage. Furthermore, these insulators do not burn in the electric arc. One such insulator withstood continuously an arc of 50 kv. and 8 amp. for fifteen minutes without being damaged so that it could no longer be used, the only damage being the decrease in the diameter due to some of the material cracking and falling off. Such an insulator weighs only 4 kg. The top and base are keyed on and the insulator is fastened to the wall with two bolts. The test voltage is 200 kv. Recently some such insulators were made of wood, impregnated with resin, but no data are yet available on their performance characteristics and behavior under unusual operating conditions.

All lead-ins are of the condenser type, made with a selected hard paper which is coated with a special varnish



*Outgoing 50-kv. and 150-kv. lines at Siebnen*

to prevent the absorption of moisture. The bushing-type current and voltage transformers are also of the condenser type and their capacities vary between 100 and 300 volt-amperes, according to make and purpose.

Each generator has a set of oil breakers for 50 kv. The breakers are in three tanks, with eight breaks each, and no explosion chambers. The interrupting capacity of each breaker set is 600,000 kva. Actual interrupting tests up to 400,000 kva. were recorded with an oscillograph. The breakers operated perfectly, with no oil throw and only very little smoke.

After a careful investigation it was decided to dispense with any kind of overvoltage protection, as well as with selective protection, reverse power relays, maximum voltage relays, choke coils, etc., and no trouble whatever has been experienced as a result.

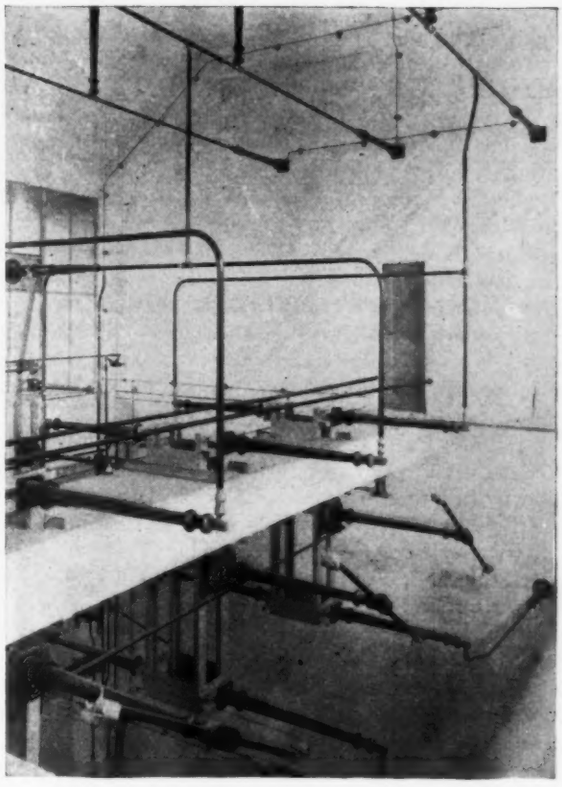
The whole plant at Rempen, which has been in operation with one generator set since the fall of 1924, and with four sets since the fall of 1925, has given very good service.

### The Rempen-Siebnen Transmission Line

The two plants, Rempen and Siebnen, are connected by four lines for 50 kv., each consisting of three conductors of stranded copper, of 95 sq.mm. cross-section. The line is 3.8 km. long and is carried on seventeen H-frame towers, whose average span is about 220 m. The insulators are of the suspension type and are made up of three links; the strain insulators consist of four elements. Since the line passes through territory where much snow falls, the four lines are, after snowstorms, connected in series at night, when no power has to be delivered, and are heated electrically. A current of 200 amp. is enough to rid the lines of any snow which may adhere to them inside of fifteen minutes.

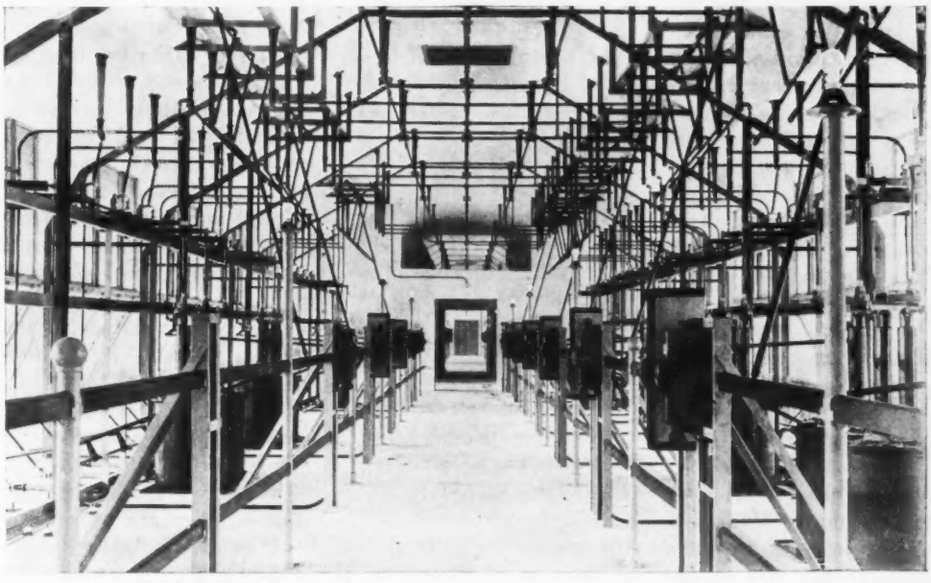
In the Siebnen power station, 3.8 km. distant from the Rempen plant, both the city of Zürich and the Northeast Switzerland Power Company have separate large distribution layouts for both 50 and 150 kv. The whole switching and circuit breaker plant is therefore located in a separate building, some 30 m. distant from the power house.

The equipment in the power house is identical with that in the Rempen station. The four vertical single-wheel Francis turbines, designed for a head of 176 to 194 m., are direct connected to four completely inclosed three-phase generators with built-on exciters rated 16,500 kva. each, at a power factor of 0.73, 50 cycles, 500 r.p.m., 8.8 kv., ± 10 per cent line voltage.



*150-kv. bus at Siebnen with disconnects*

Two of the generators are directly connected, without breakers, to two standard three-phase oil transformers fitted with closed-circuit oil cooling by means of two vertical tube coolers with water circulation. The two transformers, each rated at 16,500 kva., delta-star connected, with the high-tension neutral brought out, are of the core type. On the low-tension side they are provided with taps at 8.8, 9.2 and 9.6 kv. They can be connected either in delta/delta, 8.8/84-kv., or delta/star, 8.8/145.5-kv. They are operated with the delta-star connection and are continuously rated at 16,500 kva. at 8.8/145.5 kv. and at 18,200 kva. at 9.7/-160 kv.



*The 50-kv. switch house at Siebnen*

The other two generators are connected to two three-phase oil transformers, 8.8/-50 kv., each rated at 16,500 kva., as in the Rempen plant.

The control equipment, the temperature-measuring devices for the generators and transformers, as well as the regulating and protective apparatus, are exactly the same as those in Rempen.

Both power stations are operated from the main con-

trol room in Siebnen. In Rempen the control desks are arranged on an open gallery along the wall of the generator room and in Siebnen a completely inclosed operating room is provided, with a window into the generator room. All the panels of the outgoing lines can be supervised from the main control desk in the middle of the operating room. In this room are also concentrated the main signaling apparatus, such as private telephone Siebnen-Rempen, public telephone, radiophone, carrier-current telephone, switches for the sirens of the large and small alarms and switches for the supervisory control system, which is mounted on the wall and indicates the position of every breaker and switch in the whole plant. The switchboards and control desks in the operating room are so arranged that exactly one-half of each belongs to each of the co-operating companies.

Right underneath the control room, and of the same size, is the cable room, where all control, signal and indicating wires of the generator and control rooms are concentrated. Each panel and each desk can be disconnected for repairs or alterations. The twelve desks and 52 panels are apportioned as follows: four desks and four panels for generators, six desks and six panels for four outgoing lines and for two 50/150-kv. transformers, twenty panels for incoming and outgoing 50-kv. lines, eight panels for plant operation, eight panels for control apparatus and two desks and eight panels for expansion.

Since the switching installation is located in a separate building from the generator building, an open cable tunnel connects the two buildings. All the low-voltage conductors, comprising more than 1,000 wires for measuring purposes, signaling, supervisory control, telephones, etc., are so arranged that any cable can be exchanged for any other one without a single transposition.

The switching plant itself consists of a central part for the connections of the two co-operating companies and the plant power requirements. Adjoining this part, there are on both sides eight compartments of four meters each for 50 kv., then a passageway 4 m. wide, and then three compartments 8 m. wide for 150 kv.

The equipment for 50 kv. as well as the safety factors, etc., are the same as for the Rempen plant. In Siebnen, also, all protection against lightning and all kinds of choke coils were dispensed with. Instead of bushing transformers, transformers with wound primaries are used, with condensers, in order to make possible precision measurements at currents of 100, 200 and 400 amp. All voltage transformers in Siebnen and Rempen are connected directly with disconnecting knife switches, with no fuses. Fuses are also dispensed with in the secondary circuits. No disadvantage of this arrangement has yet appeared during the three years of operation. Although 75 50-kv. voltage transformers and 48 8.8-kv. voltage transformers are used, no transformer or other measuring instrument has yet failed. It is true that all instruments are equipped with testing terminals, but this would have been done anyway, so as to be able to connect other instruments during tests for checking purposes.

The 30 oil circuit breaker groups are rated, as in Rempen, for an interrupting capacity of 600,000 kva. While in Rempen the breakers have eight breaks in oil, those in Siebnen have only two breaks, in closed explosion chambers. The latter breakers also interrupted short-circuit currents up to 400,000 and 450,000 kva. without any difficulty, with no oil throw, and only very little smoke. The tests took place at intervals of one minute and followed the C-O-C cycle. The short-circuit tests were made with all eight generators of both stations and were recorded with oscillographs. No part of the equipment was damaged.

The 150-kv. plant was kept as simple as possible. The following clearances are observed for the high-tension lines: Phase to phase, 1,800 mm.; phase to ground, 1,350 mm.; between studs of disconnecting switches, 2,000 mm.

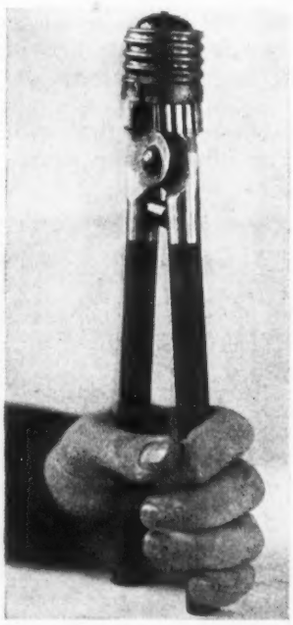
The insulators of the 150-kv. plant are made of specially impregnated beech. At a total length from middle of the clamp to ground of 1,350 mm. the flashover distance from arcing ring to arcing ring is 950 mm. The flashover voltage is 400 kv. The weight of one insulator without tube support is only 15 kg. Since the insulators were used for both horizontal and vertical rotary disconnecting switches, they had to be tested very carefully with respect to their torsion stresses and bending stresses.

Bending tests with loads up to 250 kg. at the end of the horizontally placed insulators and torsion tests up to 33 m.-kg. gave satisfactory results, so that there were no objections to the use of wood insulators. The insulators were carefully inspected repeatedly and no faults whatever were discovered. After $2\frac{1}{2}$ years the insulators were all seen to be strong enough, and even those insulators which had to carry disconnecting switches were not bent.

The voltage transformers for synchronizing, 150,000/100 volts, are connected to the line only through rotary disconnecting switches, without fuses.

The total cost of the Siebnen and Rempen plants is about 76,000,000 Swiss Francs, of which 15,500,000, or about 20 per cent, was spent for the electromechanical equipment, such as penstocks, turbine, generators, transformers, circuit breakers, and the like.

## Pliers Facilitate Lamp Renewals



*Safety, speed and better renewals are result of use of lamp base pliers*

IN ORDER to facilitate street lamp renewals, special pliers to accommodate mogul lamp bases have been developed by the Public Service Electric & Gas Company. Due to the fact that series type lamps frequently shatter on burning out, or twist free from the base on being removed, street light inspectors often experienced difficulty in making lamp renewals. Ordinary wire-cutting pliers generally burred or otherwise damaged the receptacle, resulting in poor contact and subsequent overheating.

The pliers shown in the accompanying illustration have a cast-steel head, the jaws being tapered and serrated to give easy access to the base and to maintain a firm even grip on the rim. The handles are of molded insulation, the over-all length of the pliers being 10 in., permitting their use on either pendent or inverted type fixtures.

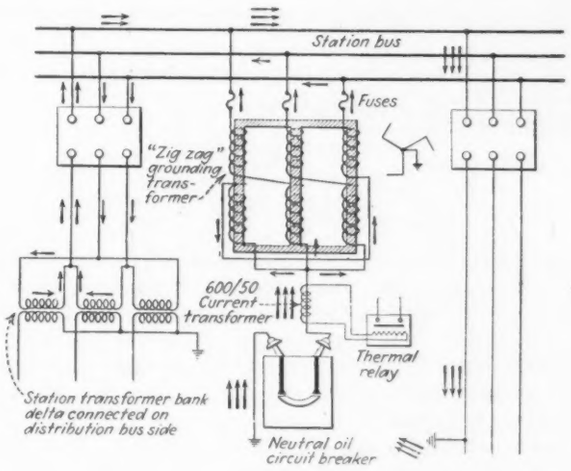
# Establish Distribution Neutral with Grounding Bank

By E. R. Stauffacher
*Electrical Protection Engineer*
*Southern California Edison Company, Los Angeles, Calif.*

IN CONFORMANCE with its practice of endeavoring to establish a neutral at the source of supply on 11-kv. and 16-kv. distribution feeders, the Southern California Edison Company has installed a number of special grounding transformer banks. These are used at substations where the station transformers do not permit a grounded Y connection to the low-tension bus. The advantages of the grounded Y connection over isolated delta in preventing arcing grounds and accompanying destructive transients and the facilitating of positive operation of relays for clearing trouble are well recognized.

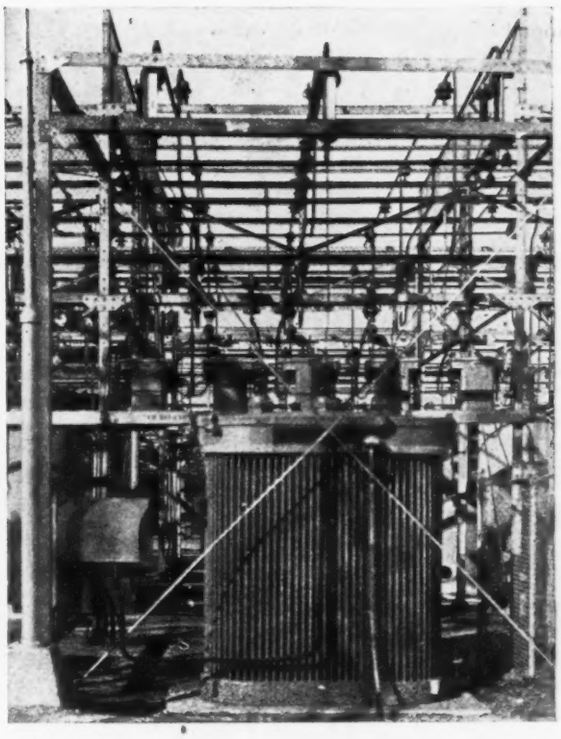
The practice of the Southern California Edison Company for the past few years has been to use three transformers, generally of 250 kva. capacity, connected grounded Y on the high-tension side and closed delta on the low side. This has now given way to the use of outdoor type, oil-insulated, three-phase "zigzag" grounding transformers built especially for the service. Such transformers possess all the advantages of three single-phase transformers and in addition are more rugged and less susceptible to damage when supplying short-circuit current. Moreover, the space required is much less and the simplicity of installation favors their use.

The Southern California Edison Company has adopted a "zigzag" grounding transformer rated at 600 amp.




*Method of applying "zigzag" grounding transformer and distribution of ground fault current*

for one minute with full sustained voltage as a standard for use on 11-kv. and 16-kv. distribution circuits. The long time rating of one minute precludes the possibility of damage to the grounding bank, and the fact that a maximum of only 600 amp. of short-circuit current can flow when one wire is accidentally grounded on a feeder limits the duty on feeder oil circuit breakers. The usual method of installation is to connect the grounding transformer to the station operating bus, using high-grade fuses of 250 amp. current carrying capacity to clear the



*Three-phase "zigzag" grounding transformer establishes neutral on isolated delta system*

transformer from the bus in case of internal breakdown The neutral of the transformer is solidly grounded through a small oil circuit breaker capable of interrupting 600 amp. at 16 kv.

As an additional protective feature to the grounding transformer, a thermal relay is so connected as to operate from a special 600/50-amp. current transformer furnished as an integral part of the "zigzag" transformer. This thermal relay is an inexpensive device ordinarily used for protection of motors and is adjusted to close its contacts when 50 amp. flows for a period of 50 seconds, which is ten seconds less than the guaranteed rating of the transformer. The closing of the thermal relay contacts opens the oil circuit breaker in the neutral and thus protects the transformer from damage due to a sustained ground or a ground hanging on as a result of failure of a feeder breaker to operate. Experience shows that there has been no occasion for the thermal relay to operate or the neutral circuit breaker to open as the feeder breakers have always promptly cleared a grounded feeder.

*ABUSES are apt to grow up in any business. These abuses should be corrected by the men engaged in the business themselves. Otherwise, they will be corrected by people who are ignorant in the matter. If you correct them yourselves, they will be corrected right. If you do not correct them, they will be corrected by compulsion and corrected wrong.*

—P. S. Arkwright,
*President Georgia Power Company.*

*A Record of Red Seal Homes*

| Licensee | —Total to Date (Since March, 1925)— Appeals Pending | Awards Made | Appeals and Awards |
|---|---|---|---|
| **United States** | | | |
| Syracuse | 104 | 228 | 332 |
| Rochester | 127 | 629 | 756 |
| Niagara Frontier | 85 | 677 | 762 |
| Pittsburgh | 325 | 792 | 1,117 |
| Louisville | 67 | 104 | 171 |
| Detroit | 659 | 1,887 | 2,546 |
| Hudson Valley | 47 | 286 | 333 |
| Grand Rapids | 43 | 39 | 82 |
| Minneapolis | 96 | 331 | 427 |
| St. Paul | 15 | 101 | 116 |
| Denver | 139 | 131 | 270 |
| Tulsa | 0 | 12 | 12 |
| Youngstown | 52 | 233 | 285 |
| California | 987 | 2,056 | 3,043 |
| Oak Park, Ill. | 58 | 121 | 179 |
| Peoria | 0 | 4 | 4 |
| La Crosse | 0 | 1 | 1 |
| Tri-Cities | 25 | 76 | 101 |
| Milwaukee | 88 | 129 | 217 |
| Kansas City | 176 | 239 | 415 |
| Toledo | 5 | 80 | 85 |
| Rhode Island | 20 | 50 | 70 |
| Chattanooga | 48 | 172 | 220 |
| Savannah | 0 | 20 | 20 |
| Elmira | 6 | 41 | 47 |
| Chicago | 226 | 312 | 538 |
| Waukegan, Ill. | 4 | 7 | 11 |
| Scranton | 6 | 5 | 11 |
| Evanston, Ill. | 63 | 75 | 138 |
| Richmond | 17 | 37 | 54 |
| Omaha | 0 | 5 | 5 |
| Muskegon | 15 | 10 | 25 |
| Alabama | 43 | 134 | 177 |
| Washington, D. C. | 1,264 | 1,121 | 2,385 |
| Lincoln | 2 | 23 | 25 |
| Calumet | 28 | 78 | 106 |
| Nashville | 12 | 20 | 32 |
| Topeka | 3 | 15 | 18 |
| Worcester | 50 | 73 | 123 |
| Fond Du Lac | 3 | 12 | 15 |
| Cincinnati | 72 | 33 | 105 |
| Sheboygan | 2 | 0 | 2 |
| Akron | .... | .... | .... |
| Binghamton | .... | .... | .... |
| Hudson-Mohawk | 32 | 103 | 135 |
| Indianapolis | 4 | 0 | 4 |
| Total | 5,018 | 10,502 | 15,520 |
| **Canada** | | | |
| Toronto | 857 | 5,797 | 6,654 |
| Windsor | 104 | 291 | 395 |
| Vancouver | 47 | 864 | 911 |

## Red Seal Homes Numerous in Many Cities

THERE are more than ten thousand Red Seal homes in the United States and nearly seven thousand in Canada, according to current records of awards.

Leading localities, in allegiance to the Red Seal ideal, according to number of applications and awards are: Detroit, 2,546; California, 3,043; Washington, D. C., 2,385, and Toronto, Ont., 6,654. The accompanying table shows the figures to date for all participating communities.

## Electric Heat Treating Proves 70 per Cent Lower in Cost

By H. E. Scarbrough
*General Electric Company, Chicago, Ill.*

A VERTICAL, cylindrical type furnace, 30 in. in diameter by 30 in. deep, was installed about a year ago at the Maytag Company, Newton, Iowa, and has proved both economical and satisfactory. It is rated 37 kw., 220 volts, single phase.

The furnace is used for normalizing and annealing small crankshafts used in the manufacture of gasoline engine-driven washing machines. These crankshafts were previously annealed in a box type oil-fired furnace. It was the usual practice to load the furnace with the crankshafts, heat them to the normalizing and annealing temperatures and then to allow the furnace to cool over night. The charge was removed the next morning and the operation repeated.

Some very accurate cost records were kept on the operation as described. Figuring oil at 7 cents per gallon and including all labor and maintenance charges, the records showed that the cost with the oil furnace was $9.20 for every 360 crankshafts heated. The weight of the small crankshafts is a little under 2 lb. per unit. With the oil furnace the shafts were trucked to the heat-treating room, where they were charged in the furnace from the containers, one or two at a time, and taken out in the same manner.

With the electric furnace the shafts are loaded into a container in the forge shop, carried to the heat-treating room and inserted while in this container in the vertical type furnace. In this manner the labor of handling is practically eliminated and about all that is required is the power consumed in heat treating the shafts. With the electric furnace, figuring electricity at 3 cents per kilowatt-hour, the cost for heating 800 shafts was found to be $5.84, a cost per 100 shafts of $0.73, as compared with $2.55 for a similar unit quantity when using oil heat.

## An Executive Attitude on Rural Service

*Excerpts from Speech by*
G. C. Neff
*Vice-President and General Manager Wisconsin Power & Light Company.*

"FARM electrification has now reached the stage where the question of utility organization to carry on this work is an important one. No utility company operating in rural territory supplying electric services to the farmers therein can hope to be successful in this work unless those responsible for the operation of the company really believe that farm electrification can pay its own way, that there is a load on the farm sufficient in amount to justify the expenditure for the required distribution lines, that the farmers can afford to pay the necessary charges for this service, and that they can profit by its use. The executives must have confidence in farm electrification if much headway is to be made in this development. If an executive believes in the permanence of this development and that general farm electrification is of benefit to both the utility and the farmers, his entire organization will soon begin to feel that same way. The farmers who deal with such an organization will soon recognize the sincerity of its aims."

# Incandescent Lighting
## *for the Movies*

**Lamp and film characteristics are complementary. Economy and ease of application greater than with arc lights. Simplified control and disposition of sources permit wide range of lighting effects**

TWO parallel, but independent, developments in motion-picture photography have united to produce a decrease in production cost and an increase in quality of product. These developments are panchromatic film and high-capacity, high-intensity incandescent lamps. The characteristics of the two are complementary, the deficiencies of the one are compensated by the excess efficiencies of the other. The sensitivity of the panchromatic film is less for those lighting wave lengths that most abound in the output of the incandescent lamp and the sensitivity is greater for the colors in which the lamp is deficient. These relative characteristics are shown in the accompanying graph. Curve *A* shows that the panchromatic emulsion, while it registers all colors, is not as sensitive in the yellow-red as in the violet-blue regions; therefore, relatively more light is needed in the yellow-red region to obtain desired photographic registration of these colors. As shown by curve *B*, the characteristic color distribution of the incandescent lamp meets this requirement, and it is evident from a comparison of the two curves that light from the incandescent source is particularly suited to provide balanced photographic registration on the panchromatic film. No filters are required.

International News Reel Photo.

*Ten-kilowatt lamps used for modeling effects*

The result of economy is attained by reduction of operating and handling labor, of energy consumed, of retakes on account of lighting failures and of auxiliary equipment. The number of men necessary to handle incandescent lighting equipment for a set of medium size is only eight to twelve, whereas twenty to thirty, or even more, have heretofore been employed. The lighter weight of the incandescent lighting equipment allows it to be handled more easily and quickly, and it is now possible to photograph more sets in a given time. Likewise, lighter and less expensive overhead supporting structures suffice. Since well-designed incandescent equipment utilizes the light very efficiently the electrical energy which studios have found necessary to illuminate sets has been reduced to one-half or even one-third of that previously employed. The light from incandescent lamps is absolutely steady, thus eliminating retakes because of intensity variations. Since the incandescent lamp operates equally well on alternating and direct current, the heavy investment and operating expense of motor-generator equipment is no longer necessary. Thus the electrical installation can be extended at a fraction of the cost formerly required.

In fact, the incandescent lamp has always been favored over other illuminants where it could be applied because of its inherent operating advantages, such as constant color quality, quiet operation, cleanliness and minimum of attention required. In the studios the actors do not photograph differently as they move about the set in range of the several lighting units, and since less make-up is necessary the effects are more natural; in addition, there is no danger of the actors' old bugbear, "Klieg-eyes." Delays incident to lamp operation are practically eliminated and periodic airing of the set to remove smoke is no longer necessary. The noiseless feature of the incandescent lamp is a quality which is essential for pictures in which sound is recorded. Since the lamps may gradually be brought from total darkness to full brilliancy, or vice versa, by means of regulators of the induction type or resistors similar to those used in theater service, effects not heretofore possible.

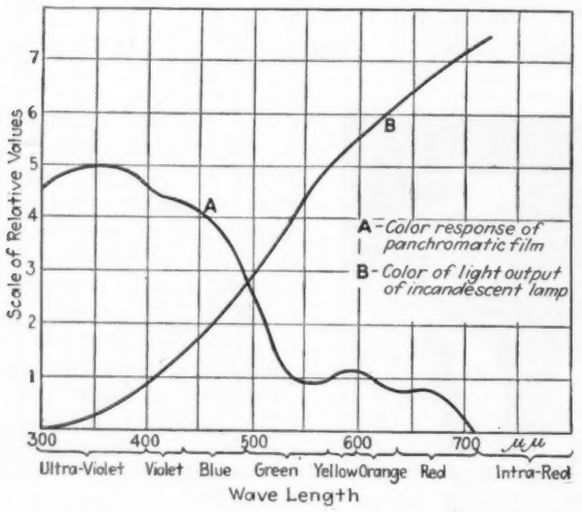
### Lighting Requirements

Color quality, intensity, distribution and direction are the important factors in the illumination of the motion-picture studio. Given a satisfactory color quality, there remains a need for such control in directing the light that the various parts of the set may appear in the proper relative brightness, with the high lights and shadows at the immediate command of the director so that he may give each scene the precise feeling and action he desires. The intensities of illumination should be sufficient to produce desired densities in the darkest parts of the picture and yet, for the brightest areas, come within the

latitude of the film emulsion. Otherwise, lack of detail and contrast must be expected.

Photography is a record of contrasts, high lights and shadows. The placing of the high lights and shadows is obviously dependent on the location of the lighting units. Their size is dependent on the size of the source, its distance from the surface and the character of the surface. The degree of the shadow sharpness depends not only on the size of the source but also on its distance from the surface.

For practical consideration, it is convenient to classify




*Comparison of color response of panchromatic film and color emission of incandescent lamp*

motion-picture lighting as general and modeling. The purpose of the general lighting is to provide a groundwork illumination which is fairly uniform in intensity throughout the set. It not only illuminates the areas that the modeling lights do not serve, but allows control of shadow density over the entire set. For the more usual cases, the general lighting should not model the actors or create noticeable high lights and shadows; this is the function of the modeling lights which the lighting director employs to create the effects desired.

Alone, the general illumination of any motion-picture set is not satisfactory, as the faces appear flat and the various actors seem equally conspicuous from the illumination standpoint. To model the features properly, to give emphasis to certain actors and to create depth additional lighting is employed to give much higher intensities over limited areas. Intensities ranging from two to four times that of the general illumination are required to produce distinct high lights, although a higher ratio may sometimes be desirable. The modeling units must be capable therefore of producing intensities of from 200 to 1,500 foot-candles over areas ranging from 3 ft. to 12 ft. in diameter, at distances from 12 to 30 ft. or more.

Desirable characteristics of the modeling lighting equipment are: (1) Continuous range of beam divergence. (2) No light outside the beam. (3) Reasonable uniformity of intensity over the area illuminated. (4) High efficiency of light utilization. (5) Adjustability from directly downward to directly upward, and 360 deg. in a horizontal plane.

The table shows the principal types of lamps applicable to studio photography. The pear-shaped (PS) bulb types are best adapted to the general lighting units and the round (G) bulb lamps to the modeling lighting equipments. The tubular (T) bulb lamps are projector types which have special applications in this field because they provide maximum light output for their bulb sizes, subject to certain limitations in the burning position.

### Equipment But Not Lighting May Be Standardized

The lighting of a studio set differs from the usual illumination design problem in that each new set may present aspects which are different from those of preceding scenes. There is no standardization of the lighting, however; there can be standardization of the lighting equipments. The tubular (R) bulb lamps are projector equipment, so that with units of known performance and characteristics there will be a minimum delay for all concerned as the scene and the lights are changed.

The lamps and reflecting equipment are but tools with which the lighting director works to produce attractive and effective photographs. Just as the artist works with paint, brush and canvas, so the cinematographer uses light, lenses and film to paint the screen pictures. With lighting units available which can produce the fundamental lighting effects with a minimum of attention to their use and operation, the creative ability of the producing artist can be employed with complete freedom and his best talents be exerted in the production of screen pictures.

## Group Meetings for New Customers

UPON completion of an extension into a district, an invitation is extended to the new users by one Northwestern power company to gather at a home in the neighborhood. Here they are met by representatives of the power company, including the district manager, the bookkeeper, meter reader, trouble man and others with whom the customer will be thrown in contact during the course of his dealings with the company.

Entertainment is furnished by talent from the neighborhood and refreshments prepared on lamp-socket appliances demonstrated by the utility. During the earlier part of the evening the old methods of illumination are used. Later an employee goes out and cuts in the line that serves the community to show the contrast.

This has proved an excellent method of encouraging appliance sales and utility security sales, as well as establishing mutual good will between company and customer.

### *Lamps for Motion-Picture Photography*

| Watts | Voltage Class | Bulb Shape | Bulb Dia., Inches | Bulb Designation | Light Center Length, Inches | Fil. Const. | Length Over All, Inches | Base | Burning Position | Service |
|---|---|---|---|---|---|---|---|---|---|---|
| 1,000 | 115 | Pear shape | 6½ | PS-52 | 9½ | C7A | 13¼ | Mogul | Any | General |
| 1,000 | 115 | Tubular | 2½ | T-20 | 4¾ | C13A | 9¾ | Mogul* | Basedown | General |
| 1,500 | 115 | Pear shape | 6½ | PS-52 | 9½ | C7A | 13¼ | Mogul | Any | General |
| 2,500 | 115 | Pear shape | 6½ | PS-52 | 9½ | C7A | 13¼ | Mogul | Any | General |
| 2,000 | 115 | Globular | 6 | G-48 | 5¼ | C13 | 8½ | Mogul* | Basedown | Modeling |
| 5,000 | 115 | Globular | 8 | G-64 | 9 | C13 | 15½ | Prong | Basedown | Modeling |
| 10,000 | 115 | Globular | 10 | G-80 | 12 | C13 | 20 | Prong | Basedown | Modeling |

*Also available with the Mogul profocused base.

# Portable Electric Home Tours Twin State Territory

By E. C. Hathaway

*Commercial Manager Twin State Gas & Electric Company, Boston, Mass.*

INSTEAD of holding electric shows last year, at a cost of $9,000, in three of the larger towns of the territory served by the Twin State Gas & Electric Company, it was decided to undertake a wider coverage by sending a specially designed portable electric bungalow of one room on a 1,400-mile tour of the field. The cost of building the portable outfit and equipping it with domestic appliances for demonstrations was found to be about $6,000, and the outside expense of the field tour during a four-month run was estimated at $3,000. By this means practically every one of the 100 communities or thereabouts served by the company could be reached and demonstrations made with minimum traveling by the local population. About 15,000 visitors registered at the exhibit during the summer and early fall when the outfit toured northern New England, making stops of a few hours in the smaller communities and from one to several days in the larger towns.

The exhibit was mounted on a special 233-in. wheelbase General Motors Company truck chassis and was wired for a connected load of about 14 kw. The major appliances included a washer, ironer, range, refrigerator, water heater and dishwasher. The wiring was arranged to permit connection to the 110-220-volt distribution system at any convenient place through flexible service leads equipped with Johnson transmission clamps. A three-pole, 100-amp., 250-volt entrance switch was provided, with ten local circuits. On the front porch was an electric roller sign of the type used by electric cars and buses, enabling the name of each local associated company to be featured in the corresponding communities. Ten exposures were provided. Running hot and cold water was provided by a 30-gal. storage tank mounted under the floor and an electric pump and piping system appropriately connected. In contrast with many exhibits of "dead" appliances, the Twin State outfit was used for actual demonstrations of cooking, washing, ironing, etc. A demonstrator and one or more salespeople traveled with the display, which was illuminated at night by 15-watt lamps under the eaves. Advance publicity, including announcement of certain domestic rate reductions, was cared for throughout the territory and attendance stimulated by offering an electric range with automatic temperature control as a prize to a lucky card registrant at the end of the tour. Each registration card required the entrant to list the appliances at present in use in his or her home, and these cards are retained as prospect lists in the local companies. The truck was driven by an experienced chauffeur who had received special training in the construction, operation and servicing of the devices in the exhibit. Orders for appliances were also taken at the exhibit.

# Letters from Our Readers

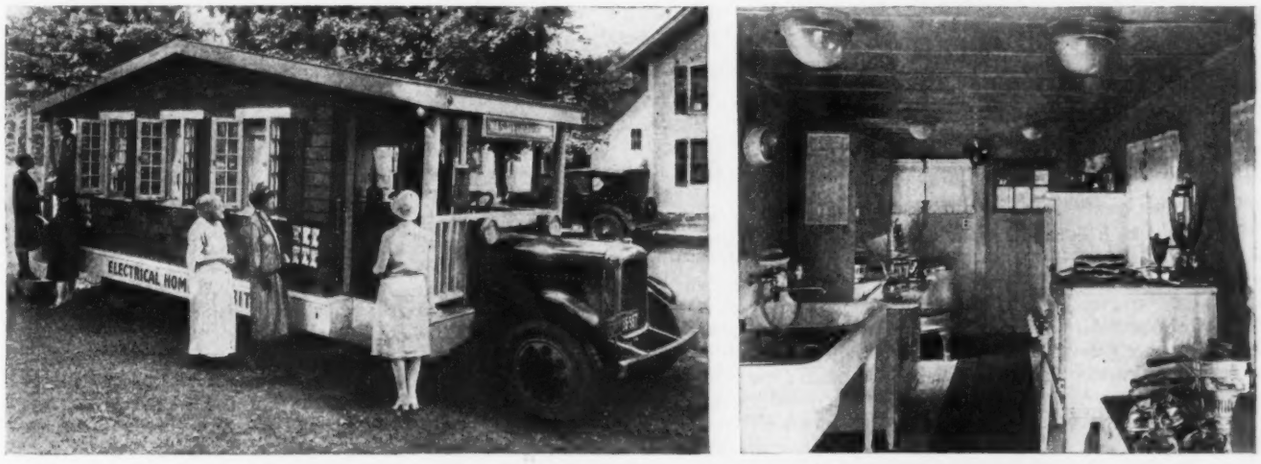
## *Protective Value of Overhead Ground Wires*

*To the Editor of the* Electrical World:

In the article on the Protective Value of Overhead Ground Wires by Howard P. Seelye, published in the Dec. 8, 1928, issue of the Electrical World, it is noted that the illustration shows one conductor arrangement of a line where one of the ground wires is in the center of the cluster of six conductors of a twin-circuit line. A ground wire in this location is, of course, quite effective in protecting against induced surges, but has very little value against direct strokes. In the past, practically all of the discussion regarding ground wires was concerning induced strokes. This was because the problem for the case of direct strokes was much more difficult and because the prevailing opinion was that all conductors would be involved, anyway, if a stroke hit a line directly.

Recent field investigation data and theoretical analysis indicate that a line does not necessarily flash over and involve all conductors upon being hit by a direct stroke. It is believed that only the more severe direct strokes flash over a high-voltage line and that ground wires may take a direct stroke and conduct the energy away without involving the line conductors in a flashover. From this viewpoint it is important that a ground wire be situated where it may receive a direct stroke, and therefore the center of a cluster of line conductors is not a desirable location for a ground wire.

J. H. Cox,
Office of Consulting Transmission Engineer.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.




*Intensive demonstrations took place aboard this rolling kitchen*

# Digest of Electrical Literature

## *Hydro-Electric Development and Steam Equipment*

*The Turbines of the Klingenberg Power Station.*—The design and construction practices adopted at the Klingenberg power station in Germany are presented in this discussion as constituting the latest continental practice in super-power stations. The construction details, general layout, economies and similar factors have been included.—*Engineer (England)*, Dec. 7, 1928.

## *Generation, Control, Switching and Protection*

*Application of Wound Type Current Transformers Installed in High-Voltage Oil Circuit Breaker Tanks.*—J. C. Rea.—Wound type current transformers installed in the tanks of high-voltage oil circuit breakers have been in operation for many years. The experience gained during this period has, according to the author, resulted in fairly clear definitions as to the types of installations to which they are best suited and to designs of transformers which are highly reliable. This discussion is an endeavor to present a brief history of some of the developments which led up to the present application of wound type current transformers in circuit breakers and to indicate some of the conditions under which they offer special advantages.—*Journal of the American Institute of Electric Engineers*, December, 1928.

*Kuala Lumpur Power Station.*— Unfavorable conditions both as to warm and humid climate and the possibility of securing a capable operating personnel for this Malaysian power station led to several unusual design practices. Cooling water conditions were not ideal and it was necessary to use two ponds for securing the necessary volume. The local fuel has poor storage characteristics and special provisions were necessary to prevent spontaneous combustion. Open-type construction has been used throughout this power house and while the present generating capacity is provided by three machines totaling but 9,000 kw. the plant has been fully equipped and designed for future expansion under the local limitations previously indicated.—*Far Eastern Review (China)*, November, 1928.

*Manchester Electricity Undertaking.*—Some of the details of the Barton power station, which constitutes a 40,000-kw. extension of the original 82,500-kw. section of what is said to be the most efficient steam-driven electricity generating station in Great Britain, are given in this discussion. The present extensions include three marine type water-tube boilers, two of which are chain-grate fired and the third burns pulverized coal. Each is equipped with an economizer, superheater, air heater, forced and induced draft fans and a steel chimney with a grit arrester. The bin and feeder system is used for the pulverized fuel installation. Reactors are employed to connect the main busbar sections and are also used in series with the service transformers. The latter arrangement is considered an important feature since a fault on a house-service transformer becomes practically a short circuit on the busbars and the reactors thus limit the damage to the transformer itself and help to maintain the voltage on the busbars. Protection consists of circulating current across a combined generator and transformer with the addition of core-balance leakage on the 33,000-volt transformer winding, and separate leakage for the generator and 6,600-volt transformer windings.— *Electrical Review (England)*, December 7, 1928.

## *Transmission, Substations and Distribution*

*High-Voltage Outdoor Substations.*—L. Vellard.—The electrified railway from Paris to Orleans derives its current supply from either the main steam plant of the Parisian metropolitan stations or from French hydro centers, recently connected with Paris over a 150-kv. line. The rotary stations of the railway are equipped for a primary supply of three phase, 90 kv., so that transformer connections must be provided between 150-kv. (transmission line), 62-kv. (Paris) and 90-kv. (railway) potentials. The article describes two of the transformation points, one at Chevilly, near Paris, with at present 100,000 kva. installed transformer capacity, the other at Chaingy, near Orleans, with a capacity of 40,000 kva. Both stations are outdoor type, with transformers, metering outfits, circuit breakers and lightning arresters installed under a heavy overhead steel construction. The entire equipment, including the indoor motor-generators, is either American built or made in France from American designs.—*Revue Générale de l'Electricité*, November 10 and 17, 1928.

*Cooling of Large Transformers.*—A. H. Altmann.—The cooling of large transformers, or the safe dissipation of their losses, is a difficult problem, because the losses rise with the cube of the linear dimensions, while the heat-dissipating surface goes up only as the square. Nevertheless units of as high as 60,000 kva. and one testing transformer of 100,000 kva. capacity have been built and are in successful operation. With the adaptation of the American type of radiator, the capacity of self-cooled transformers was greatly increased, reaching up to 30,000-kva., single-phase units. For larger machines artificial cooling has to be resorted to, such as forced air cooling or water cooling. The latter method sets no upper limit and can be arranged in various ways. The oil can be cooled externally by forcing it through water-immersed coolers, or a water-traversed cooling coil can be placed within the transformer. If there is reason to doubt the reliability of tight joints in the cooling coils, the transformer can be kept under higher pressure than the cooling water, so that in case of leakage the oil enters the water. In some installations the floor space for the transformer proper is limited, in which case the oil has to be cooled at some distance away. Banks of radiators are then used, to which the oil is delivered by motor-driven pumps.—*A.E.G. Progress*, November, 1928.

## *Units, Measurements and Instruments*

*Electric Measurments.*—This special issue is devoted to the description of latest developments in electric measuring methods and instruments, comprising nine major articles. Remote measuring, precision instruments, universal current transformers and a novel type of high-voltage potential transformers weighing but one-tenth of the customary type are among the outstanding items.—*Elektrotechnik und Maschinenbau*, November 11, 1928.

*High-Voltage Potential Transformer.*—A. Imhof.—To reduce size, weight and cost of high-voltage potential transformers, the author has developed a small current transformer, the primary of which is in series with a high ohmic resistance, made of numerous coils of fine, insulated resistance wire. The individual coils are stacked and placed in an oil-filled insulating tube, at the bottom of which is a small current transformer, also oil-immersed. While a 120-kv. customary type of potential transformer weighs about 10,000 lb., the equivalent new type weighs but 560 lb. For outdoor installation a tall and petticoated porcelain tube is placed around the insulating cylinder, with a weatherproof top and bottom. To avoid high-voltage danger from open secondary a pair of neon tubes is permanently connected across these leads.—*Electrotechnick und Maschinenbau*, November 11, 1928.

## *Illumination*

*Glare and the Four Fundamental Factors in Vision.*—P. W. Cobb and F. K. Moss.—A further contribution to the discussion of the subject of glare. Experimental data consisting of measurements of visibility are presented showing the effect of a range of glare conditions upon a wide variety of test objects. These not only confirm earlier work upon the subject but show that the result of the measurement depends to a very large extent upon the test

object selected. A number of suggestions as to the improvement of present-day lighting for work are made with a view to the reduction of glare to a negligible minimum. The authors suggest that by a combination of good general lighting plus well-designed supplementary lighting a total installation can be produced which is practically glareless, since by virtue of the high level of illumination upon the visual object the effect of the glare already present from the general overhead lighting may be reduced to a negligible value as measured in terms of visibility.—*Transactions of the Illuminating Engineering Society*, November, 1928.

*Illumination of Operating Tables.*—H. HARTINGER.—In former years operating rooms in hospitals were painted white and the illumination was arranged in such a way as to provide intense and uniform light all over the room. Arc lamps were used frequently, placed outside the room for aseptic reasons, and their light beams were caught within the room by mirrors to be directed and diffused as desired. In late years a complete change was brought about, by a desire to concentrate practically all the light upon the operating table, leaving the rest of the room in semi-darkness. The floor, walls and the ceilings are now painted in dark colors, even the drapings on the patient are made of gray linen, to obtain a maximum of light contrast. "Mazda" lamps have superseded the arcs, and every effort is being made to obtain an intense but shadowless light beam, which penetrates even into the deepest incision. A world-known German optical concern has developed a totally reflecting illuminant, consisting of an ellipsoidal silver reflector with a 150-watt lamp and a small conical counter reflector. The resulting powerful light beam is entirely shadowless. To reduce the heat effect a filter made of blue-green iron-suboxide glass is placed in front of the reflector, cutting out entirely all rays below 350 $\mu\mu$ and above 700 $\mu\mu$ wave lengths.—*Elektrotechnische Zeitschrift*, November 22, 1928.

## *Electrophysics, Electrochemistry and Batteries*

*Insulation Materials.*—H. WARREN.—A general review of natural and vitrified insulations, including molded composites, sheet materials, varnishes, treated materials and wire coverings. The author has endeavored to evaluate the dielectric characteristics of a number of commonly used materials and to point out the limitations and advantages of each. The possibilities of some materials, little used at the present time, have also been discussed and the great increase in the use of synthetic molded compounds pointed out.—*Electrician (England)*, November 30, 1928.

*Some Special Tests for Insulating Materials.*—A. R. DUNTON.—A number of specially designed devices which may be used for testing insulating materials have been described in this article. Particular attention has been devoted to apparatus suitable for the examination of papers and boards and the possibilities and limitations of such equipment have been analyzed.—*Electrician (England)*, December 14, 1928.

## *Heat Applications and Material Handling*

*Modern X-Ray Apparatus.*—L. G. H. SARSFIELD.—An analysis of the equipment commercially available for the purpose of making X-ray investigations, particularly as involving industrial requirements. The author points out that many of the difficulties which hampered the development of this type of equipment several years ago have been satisfactorily solved today, but that it may be that for the higher voltage X-ray work of the future there will be a reversion to some improved form of induction coil outfit. This experiment includes the use of voltages up to 1,000,000 and also of rapid discharges from condensers for energizing X-ray tubes. Rapid discharges represent a minimum of time exposure and therefore make for better radiography of objects which cannot be held still. It is indicated that a considerable amount of work remains to be done on the development of simple control apparatus to include automatic and safety features so that the adoption of X-rays in industry may not be hampered by the necessity for laborious manipulation of switches nor by the risk of any breakdown of the high-voltage system involving the operating gear. A number of the technical features of modern equipment have been reviewed critically and future developments pointed out.—*Electrical Review (England)*, December 7-14, 1928.

## *Traction*

*Japanese Railway Electrification.*—The Ministry of Railways of Japan has, according to this article, decided upon the electrification of nine sections of five trunk line railways to take place over a period of six years. This plan will go into effect next year and it is contemplated that all sections of the railways which are spotted with tunnels or heavy grades will be electrified within the period indicated. Steam-generating units of 20,000 and 25,000 kw. capacity are being installed and provision is made for their operation as synchronous condensers under necessary system conditions.—*Far Eastern Review (China)*, November, 1928.

*Locomotives with Vertical Motors.*—E. LINSINGER.—The latest type of express locomotives for the Austrian Federal Railways marks a radical departure from all former designs. Each of the four driving shafts carriers between the wheels an elaborate flexible bevel gear, into which meshes the pinion of the vertical shaft driving motor. The introduction of this type of motor changes many well established locomotive rules of the past. The author claims that, formerly, the designers of electric locomotives have been influenced too much by the precedents established in steam engine drives. Slow-speed motors and any kind of rod drive are contrary to the characteristics of an electric motor and are survivals of steam practice. The vertical motor needs a thrust bearing to take up heavy axial pressure when starting, caused by the spiral bevel gears. After covering 80,000 miles, a wear of only 4/10 mm. was noticed on the thrust bearing. The good experiences with four of these engines during a period of thirteen months of heavy duty prompted the ordering of 29 additional locomotives, each equipped with eight vertical motors.—*Elecktrotechnische Zeitschrift*, November 29 and December 6, 1928.

## *Miscellaneous*

*Poultry Farming with Electricity.*—F. E. ELLIS.—Electricity has been liberally adopted on the large Canadian farm described in this article. The development is devoted largely to chicken raising and a 20,000-egg electric incubator used here has a record of hatching 60 per cent of the eggs even under unfavorable conditions. Electrical energy has been fully utilized and cost data and performance records have been included.—*Electrical News (Canada)*, December 1, 1928.

*A Study of the Failure of Concrete Under Combined Compressive Stresses.*—FRANK E. RICHART, ANTON BRANDTZAEG and REX L. BROWN.—An investigation was undertaken by the authors to determine the causes and mechanics of failure of concrete under compressive stresses applied in one, in two or in three directions perpendicular to each other, the aim of the tests being to study the internal action of the material as it breaks down under compressive stress and at the same time to obtain information on the influence of lateral stresses upon the ability of concrete to resist longitudinal stresses. A number of conclusions have been drawn as the result of this examination, including that, in general, the strength of the material in biaxial compression is as great as in simple compression and that in many cases it is greater; the strength of the concrete in triaxial compression was found to increase greatly with the magnitude of the smallest principal stress; much of the deformation under triaxial loading was due to an inelastic reduction in volume or a compacting of the concrete under stress; the tests of concrete in simple compression showed characteristic differences in behavior throughout three distinct stages of loading; it was also stated that many of the numerical results of the tests approach an agreement with the internal friction theory of sliding failure, but that the great increase in lateral deformations mentioned cannot be reconciled with a conception of failure as taking place through a sliding on plane surfaces continuous throughout the material.—*Bulletin No. 185, University of Illinois.*

# News of the Industry

## To Fight Boulder Dam Act in Supreme Court

*Colorado River Commission of Arizona Files Suit—Governor Dern of Utah Advises His State Against Immediate Ratification of Compact*

ARIZONA'S Colorado River Commission has authorized the immediate filing of a suit in the United States Supreme Court in an attempt to prevent construction of the Boulder Dam as contemplated in the Swing-Johnson law enacted by Congress. The ground of the suit will be that the act allocates to California waters from the Colorado rightfully belonging to Arizona.

Governor Dern of Utah in his message to the Legislature of that state on January 15 recommended that Utah take no immediate action on ratification of the Colorado River compact. "In view of the situation, I hope and, indeed, believe Arizona will ratify the compact, in which event no further action by Utah will be necessary. I therefore think it would be unwise for us to do anything until we see what Arizona's attitude is going to be," Governor Dern said.

By the terms of the Swing-Johnson bill at least six of the seven Colorado River Basin states — Wyoming, Colorado, Utah, New Mexico, Nevada, Arizona and California—must ratify the compact originally drawn up at Santa Fe in 1922. California, Nevada, Wyoming, Colorado and New Mexico have approved it.

## New Muscle Shoals Bill Introduced in Senate

Another bill providing for government operation of Muscle Shoals was introduced in the Senate on January 5 by Senator McKellar of Tennessee. He explained that his bill was almost identical with the Norris measure passed last season which met a pocket veto from President Coolidge. The only difference, he declared, was that the provisions of the new measure would be carried out by the Secretary of War rather than by a special board. Senator McKellar said that he would seek to have the bill made a "temporary expediency" until the whole question could be disposed of.

## Austin, Tex., Decides to Build Auxiliary Plant

The Austin (Tex.) City Council has decided to order immediate construction of an auxiliary power plant to cost approximately $460,000 and virtually double the output. The Council voted four to one for construction. In taking this action it definitely rejected the Texas Power & Light Company's offer to furnish the city with electricity at 8 mills per kilowatt-hour on a five-year contract. The offer of the Southern Utilities Company to pay the city $5,000,000 for its plant and the water and light franchise was virtually rejected, too, since no way of obviating a necessary two-year charter delay appeared.

## Uniform-Rate Hearings Begun by New York Commission

Many well-known utility executives attended a hearing before the New York Public Service Commission held at Albany on Tuesday of this week on the question of devising uniform and simplified forms of rates for electric and gas companies. Chairman Prendergast said: "A schedule which the customer of the utility is able to understand, the purpose of which can be made clear to him, the reasons for the elements of which can be presented to his understanding—all of these things are very much in the interest of good relations between the public and the utilities and very much in the interest of better regulation."

Representatives of nearly all of the larger operating companies in the state offered full use of their facilities to aid the commission's study; E. B. Titus, representing the Farm Bureau Federation, emphasized the approval of his organization, and Assistant Corporation Counsel M. Maldwin Fertig of New York City promised its aid and possibly some testimony.

Gas rate forms will be taken up first. Hearings so far set will be on February 18 to 21 and 25 to 28 inclusive.

## Westinghouse Appoints New Chairman of Board

Official announcement was made by the Westinghouse Electric & Manufacturing Company on Wednesday, January 16, of the election of A. W. Robertson, president Duquesne Light Company, Pittsburgh, to be chairman of the Westinghouse board of directors, an office which has been vacant since the death of Guy E. Tripp on June 14, 1927. Paul D. Cravath, the company's general counsel, was made acting chairman soon after Mr. Tripp's death. Mr. Cravath will continue on the board, to which Henry B. Rust of Pittsburgh has been added. A biographical sketch and portrait of Mr. Robertson will be found under "News About Men of the Industry" (page 169).

## Submetering History Is Told by Williams

*Former Commercial Vice-President of New York Edison Explains Origin of System and Dwells on Question of Competition from Private Plants*

ON THE resumption in New York City on January 11 of testimony before the New York Public Service Commission on the submetering situation, Arthur Williams, former vice-president of the New York Edison Company in charge of commercial relations, who resigned two months ago, was called to the stand at the instance of the submetering companies and explained the origin and growth of the submetering system in Manhattan Borough. Mr. Williams, who disclaimed any desire to pose as a critic of the new Sloan administration in this matter, expressed his own view that abolition of the submetering companies, as now urged by the power companies before the commission, would tend only to aggravate the difficulties of the situation by increasing the number of private power plants operated.

It was this problem, Mr. Williams disclosed, which gave rise to the system of submetering and led the power companies to avoid throwing any obstacles in the way of its development. The electric power and light business, he said, has a problem shared by no other public utility in that it is "at all times exposed to keen competition from private plants." Before 1915, he said, the company gave meters to the property owners free of charge and billed them on the aggregate amount of energy consumed in the building. Very frequently the rate on this was set, he explained, by calculating the total amount of energy which would be used not only in the operation of the building but also by the tenants.

In 1915 this method was subject to review by the Public Service Commission, which decided that thereafter only one meter, or its equivalent, was to be given each consumer, which meant that if a property owner were to purchase wholesale energy for his building, he would have to install his own meters. "After that ruling," said Mr. Williams, "the submetering system arose." At that time, he said, virtually every large building was planned in such a manner that a private plant could be included, and the competition between such plants and the New York Edison Company was keen. "In my opinion," he continued, "had submetering not been permitted it would have been practically impossible to secure the contracts for any of the larger buildings erected in the last ten or twelve years."

Similarly, he said, in reply to a question put by S. Stanwood Mencken, attorney for a number of the submetering companies, he felt that abolition of the system now would tend to increase the use of these private plants, reacting unfavorably upon the business of the power companies. Submetering, Mr. Williams declared, is a "product of the differential between wholesale and retail rates, and the problem will naturally solve itself when the differential is reduced by diminishing the spread between these rates."

The charge of "gouging" was brought against the New York Edison Company by Oscar Hirsch, president of the Electric Consumers' Adjustment Corporation, a submetering concern, who asserted that for 25 years he had been engaged in the business of "getting back rebates for customers who had been overcharged by the New York Edison." The commissioners seemed inclined to consider these accusations irrelevant and were more interested in Mr. Hirsch's assertion that submetering companies "which know their business" were in favor of regulation by the commission and "had tried to get it for years." "Will you come to Albany and support a bill providing for such regulation?" asked Chairman William A. Prendergast. Mr. Hirsch replied vigorously in the affirmative.

President Sloan underwent more examination on his previous testimony. He said in part:

We are not making this fight principally in the interests of the utility companies. They will get along, win or lose. This fight is really for our customers, who now are paying at least $14,000,000 a year more than they need to for electrical energy generated by us. We can save them at least that much, without impairing our revenues. We will do that and more. In Brooklyn, with practically no submetering, we have reduced our rates and cut revenues $8,000,000 in the past three years. In Manhattan the prevalence of submetering has prevented any reductions whatever in rates, aside from the general elimination of the coal surcharge. The Manhattan rates are kept unsoundly high owing to the uneconomic situation produced by the submetering companies. Since 1920, in Brooklyn, we have displaced 168 private plants in favor of Brooklyn Edison service. Of these 168 premises only five are now submetering. There is not a private plant in an apartment or multiple-family dwelling in Brooklyn, and only six private plants, which are selling electricity to tenants. Our rates have prevented the private plant from being a factor in Brooklyn; we will do the same thing in Manhattan.

The next hearing was set for Monday, January 28.

## New York Edison Rate Case Five Years Old

The end of the rate proceedings instituted by Mayor Hylan of New York City about five and a half years ago before the Public Service Commission of the state in an attempt to force down the schedules of the New York Edison Company is not yet in sight, although it is said that the company has spent approximately $4,000,000 in presenting its side of the case and that the city has spent between $200,000 and $400,000. The files of the commission are overflowing with the great mass of evidence. That body has been waiting for the city attorneys to come forward with additional information on the case.

On Wednesday of last week the city began with the new evidence, and Otto M. Rau, a consulting electrical engineer of Philadelphia, testified regarding the age and value of equipment. A vast amount of documentary evidence was also presented by the city. The hearing was adjourned until January 28, after which it is expected to continue intermittently.

# In the States' Legislative Mills

### Texas to Deal with Regulation—West Virginia Has New Water-Power Bill—Minnesota Governor Opposes Dams on Border—UtilityMatters in Other States

STATE legislatures are getting under full headway in all parts of the nation, and in most of them bills affecting light and power companies directly or indirectly have appeared or will do so. Among these political activities are the following:

TEXAS.—In response to the recommendation of Governor Dan Moody, the Texas Legislature will consider the enactment of laws for the regulation and control of electric power and other public utility companies. In a message, Governor Moody dealt at some length with the public utility situation, saying in part:

Somebody should stand between the consuming masses and the company or companies furnishing public utility service to the public. The power and duty to regulate the conduct of such companies and the rates to be charged, under a holding of the Supreme Court of the United States, rest on the State Legislature. Some of the larger cities have regulations, but with this exception and the limited control which the Railroad Commission has over gas companies, there is practically no regulation of this big industry. If exorbitant rates are being charged the consumers, the average city or town is practically without the legal power and finances, under existing law, necessary to correct the abuse or to make an inquiry into the matter and bring about an adjustment. Our statutes were written when there were few utilities in this state and, for the most part, such as existed were small local concerns. . . .

Every public utility company is entitled to a fair return on the reasonable value of the property used in the public service, after the legitimate cost of operation is deducted, but it is impossible for any city, without tremendous expense, to make the necessary inquiry to determine what rate would yield such return. Especially is this true when the city happens to be one of many served by the same lines. The information can only be acquired by technical and experienced men, and these are expensive. . . . These questions are growing more emphatic and complicated every day, and the time has come in Texas when steps should be taken for the supervision and regulation of these utilities. The masses of consumers should be given a measure of legal protection from excessive rates.

WEST VIRGINIA.—That hydro-electric development will be among the major matters to come before the West Virginia Legislature at this session is presaged by a bill prepared by Senator T. H. Lilly of Summers County. This bill is modeled to a great extent after the Keatley bill, as amended in the House last session before the substitution of another measure which limited the sale of power generated in West Virginia to the confines of the state except as to railroads and for the generating companies' own use without the state. The Lilly bill imposes no such limitations. Under its terms the Public Service Commission of West Virginia would have jurisdiction over the granting of water-power rights and franchises and would be authorized to make investigations and to collect data concerning the utilization of the water-power resources of any region proposed for development, including the effect of any proposed development upon cities, towns or villages, upon the prospective development of other natural resources and upon railroads and other means of transportation. The commission would be required to make investigations of the entire watershed which might be affected by any proposed development and to weigh from the standpoint of the state as a whole the advantages and disadvantages. The Governor of the state would be made a member of the Public Service Commission for passing upon water-power applications, with the same power and vote as the other members. Licenses would be granted for a period of not exceeding fifty years, at the expiration of which the commission would be empowered to grant an extension not to exceed another fifty years. A royalty tax of 1 per cent of the gross revenue from the sale of energy produced from the plant under license would be levied. A license would be required to commence the construction of a project within two years after its plans were approved. No license would be permitted to acquire by condemnation any existing hydro-electric development which on January 1, 1927, had an installed capacity in excess of 1,000 hp.

A bill very similar to the Lilly measure, just described, was introduced on Tuesday of this week by Senator Hugus.

OHIO.—In his first message to the General Assembly of Ohio, delivered January 15, Governor Myers Y. Cooper recommended repeal of the Pence law, under which utility corporations are now able to charge increased rates, under bond, before they are approved

and authorized by the Public Utilities Commission. Under the provisions of Governor Cooper's platform, a judicial body of three would be appointed, to be known as a fact-finding division, to investigate cases submitted to the commission. Utilities seeking to increase their rates would be required to present *prima facie* evidence, which would be reviewed by the fact-finding body for final adjudication. A bill embodying the recommendations of the Governor will supplant the bill introduced by Representative Summers and noted last week (page 115).

MINNESOTA. — That Governor Theodore Christianson of Minnesota intends to fight against plans to utilize Canadian boundary waters in the production of electrical energy is indicated in his biennial message to the Legislature. The Governor reviews the situation, from his standpoint, as follows:

A problem arising from conditions in northern Minnesota issues out of attempts to interfere with natural water levels along the Canadian border. Three years ago private interests made application to the Federal Power Commission for a permit to convert some of the lakes along the international boundary east of Rainy Lake into impounding reservoirs for the development of water power in the streams below. Believing that the need for industrial development in that section was not sufficiently pressing to justify the destruction of lakes and woods for recreational purposes, the state appeared at the preliminary hearing at International Falls to oppose the application. Engineers representing the governments of the United States and Canada have since been at work making topographic surveys of the areas involved in order to ascertain the effects of the proposed water-level changes on lakes and shore lines. When their report is filed it is believed that there will be ample data with which to sustain the state's opposition to the proposal.

Meanwhile there should be new legislation, both state and federal, to enable public authorities to deal effectively with the water power problem. The public waters of Minnesota are capable of producing electrical energy to the extent of 500,000 hp.—the equivalent of the energy produced by burning a million tons of coal per year. Only half of this water power has been developed. As a part of the great industrial expansion that is now under way throughout the nation, the rest of it probably will be developed within the next decade. With us rests the responsibility to see to it that it shall be developed under the control of public authority, with provision for recapture and for reasonable regulation of rates and service and with due regard to recreational and esthetic values. There is no greater responsibility confronting us at this session.

There is pending in Washington the Shipstead-Newton bill, which prohibits water-power development in the streams and lakes within the area of Superior National Forest without the consent of the Congress. It ought to be passed, and I recommend that you address an appropriate memorial to the Congress urging its enactment.

WISCONSIN.—The special committee of the Wisconsin Legislature that has been investigating the water-power situation in that state will soon be heard from. There are almost certain to be majority and minority reports, but which will be the majority report and which the minority is not yet certain. The committee probably will be unanimous for the recommendation of legislation permitting the creation of power districts embracing a number of municipalities for the purchase or construction of light and power plants and the distribution of the light and power; but there is a divergence of view as to whether the state should take over the ownership of the water powers as soon as possible under the recapture clause of the water-power law, as to whether a constitutional amendment should be adopted modifying the clause in the constitution forbidding appropriations for internal improvements to permit state appropriations for the purchase of water powers, and as to whether power should be lodged in municipalities to construct public utility plants rival to existing plants without recourse to condemnation.

WASHINGTON.—Petitions bearing more than 50,000 signatures on Initiative Measure No. 1, the county-unit power bill, have been filed with the Secretary of State. This lays the groundwork for the renewal of the old legislative fight involving the taxation of municipal utilities, the extension of municipal ownership and the activities of privately owned companies. Municipal ownership advocates are marshaling forces for a show-down fight, while opponents of the measure are preparing to meet them with a proposal that taxes be imposed upon municipally owned projects. The measure just referred to would authorize counties or parts of counties to create power districts and operate and maintain power plants and distributing system, such plants to be either purchased, condemned or erected.

MISSOURI.—A recommendation that the Missouri Public Service Commission be placed on a permanent basis of assured financial support by levying a tax upon public utility companies has been prepared by the Missouri State Tax Commission for transmission to the Legislature. The proposal is designed to eliminate the present necessity of the Public Service Commission having to depend upon fluctuating appropriations by the Legislature every two years. The exact method to be adopted is left to the Legislature.

NEBRASKA.—Proposed legislation by the Nebraska House and Senate affecting utility companies includes the following: Elimination of monthly service charge; requiring electrical energy to be sold at same price in all sections, making allowance for differing cost of production; forbidding municipal plant to be sold as now by three-fourths vote of council (sale must be authorized by 60 per cent of voters at an election called by 30 per cent); forbidding sale for other than present cash consideration; permitting municipal plants to construct transmission lines to points distant as far as 25 miles for sale of energy; taking electric light revenues from municipal plants from annual appropriation and making them available for improvements and extensions; giving municipal plants lien on real estate for unpaid bills; authorizing pledging of their future earnings for repairs or extensions; forbidding municipalities from contracting for electrical energy for more than five years, unless authorized by 60 per cent vote of electors; reducing from 25 to 15 years the period that cities of the second class and villages may grant lighting franchises, requiring 60 per cent vote for approval and setting out maximum rates to be charged; constitutional amendment limiting to 25 years all grants and leases of water sites for power purposes. Most of these were introduced at request of the League of Municipalities.

NEW YORK.—A compromise water-power bill which both Governor Roosevelt and the Legislature could approve is still talked of at Albany, and conjectures concerning such a measure fill a considerable part of the news from the state capital as reflected in the daily journals. As yet, however, there is nothing concrete on which to base them. Among bills introduced in Assembly are one to bring submetering companies under commission control and one to amend the labor law in the interest of the safety of electric linemen.

NEW JERSEY.—In his inaugural address Governor M. F. Larson urged the Legislature to give the most serious consideration to the tri-state treaty with New York and Pennsylvania for the allotment of the waters of the Delaware River. This treaty has in previous years been favored by the New York and Pennsylvania Legislatures only to be blocked by New Jersey.

MASSACHUSETTS. — Representative Shattuck has filed a bill relative to regulation and supervision of gas, electric and water companies. The purpose of the bill is to provide that the basis for determining rates shall be the capital stock paid in plus that part of the surplus which will represent an average of no more than 7 per cent dividends.

NEW HAMPSHIRE.—The Governor of the state has laid down his policy on utility companies, indorsing the proposed franchise tax upon them. He insists that all the power produced in the state must always be available in the state and only the surplus allowed to cross the state lines. The Governor also would continue the present policy of granting exclusive right of service in any territory to the developing company therein. Finally he observes: "I believe the greatest benefit both to public and consumer will be derived from a constructive form of regulation which not merely determines rates and service, but which stimulates economical service and efficient management and encourages honest financing."

## Purchases and Mergers

Negotiations looking toward the merger of the Boonville (Ind.) Electric Light & Power Company with the Southern Indiana Gas & Electric Company of Evansville, controlled by the Commonwealth Power Corporation of New York, are under way. The pro-

posed price is said to be about $1,000,000. The Boonville plant supplies also six nearby places.

The New York State Electric Corporation of Ithaca has applied to the Public Service Commission for authority to acquire the Western New York Gas & Electric Corporation of Lancaster.

# Light on Industry Publicity Still Sought

## Trade Commission Asks Senior Editor of "Electrical World" About Wyer's Report on Ontario Hydro—Mrs. Sherman's Articles Another Subject of Inquiry

By Paul Wooton
*Washington Correspondent for the* Electrical World

LACK of newspaper interest in the recent utility hearings before the Federal Trade Commission is attributed to the fact that the commission simply is picking up the fag ends of the publicity part of its probe. The important part of its work now is centered in the offices of the holding companies. Information reaching Washington indicates that the public still has a one-sided picture of the situation. It is believed, however, that this will be overcome when the utilities, early in February, have an opportunity to present their side of the case in their own way.

In examining W. H. Onken, Jr., the senior editor of the Electrical World, who testified on January 16, Judge Robert E. Healy, the commission's chief counsel, explained that the principal need for subpœnaing Mr. Onken had passed. He did not reveal what had been the original intention. He asked a few questions, however, as to the ownership of the McGraw-Hill Publishing Company and as to Mr. Onken's knowledge of the report made by Samuel S. Wyer on the Ontario Hydro-Electric Power Commission.

In reply to Judge Healy's questions Mr. Onken explained that the McGraw-Hill company had been, prior to the public offering since January 1 of a small block of its common stock, owned entirely by its officers and employees. He said that no public utility interests ever owned a dollar's worth of the company's stock, explaining also that this applies as well to electrical manufacturers and all other advertisers in the various McGraw-Hill publications.

In reply to further questions, Mr. Onken told briefly of his service as a member of various committees of the National Electric Light Association. Pursuing persistent efforts to learn who paid Mr. Wyer for his Ontario report, questions along this line were asked Mr. Onken, who asserted that he had no knowledge who paid for the report. He explained that he had looked over Mr. Wyer's manuscript at the request of the managing director of the National Electric Light Association, but solely with the idea of checking statements of fact.

Henry C. Spurr, Rochester, N. Y., editor, and A. Stedman Hills, Washington, business manager, of *Public Utilities Reports*, were questioned about that publication, and it was brought out that it is published by a stock-holding company at a loss, which is made up through utilities and others interested in the publication of commission decisions.

When the commission resumed its hearings last week, on January 10, testimony in regard to the activities of the Alabama Public Utilities Information Bureau, which operated from 1922 to 1926, was taken from that organization's former director, Leon C. Bradley. Its activities, as testified to, consisted primarily in the publication of a weekly bulletin. Annual expenses were $15,000 or $18,000. A brief survey of textbooks used in the schools which related to utilities was made, but no action followed.

On the following day the circumstances under which Mrs. John D. Sherman, when she was president of the General Federation of Women's Clubs, was paid approximately $600 a month for two years for writing a series of two articles a month, intended for publication in certain popular magazines, were brought out. These articles, Mrs. Sherman testified, advocated an increased use of electricity in the home. They had nothing to do with water power or public questions, she said; the National Electric Light Association did not influence their contents, and in receiving payment for them she was following a custom sanctioned by the federation of which she was the head.

It was shown that Mrs. Sherman was paid for these articles through Lord, Thomas & Logan, acting as literary agents for her and at the same time conducting a publicity campaign for the N.E.L.A. George F. Oxley, publicity director of that association, testified that only twelve or thirteen of the articles were actually printed, that a total of only $116 was received from the magazines in payment for them and that the association made up the difference.

Mrs. Sherman testified that in her four years' incumbency of the federation presidency contributions totaling $80,000 from the N.E.L.A., together with $3,000 from the American Gas Association, had been received by her organization as direct contributions to finance a home equipment survey made by the women's federation.

Another witness was F. G. R. Gordon of Haverhill, Mass., once a socialist, who testified to substantial payments made him by the N.E.L.A., the American Gas Association, and afterward by the Joint Committee of National Utility Associations, for a thousand speeches and five thousand articles attacking public ownership. These were spread over a period of thirteen or fourteen years.

# Farm Service Appeals to Kentucky Men

*Louisville Meeting Hears from Speakers Inside and Outside the Industry Concerning Progress in This and Other Utility Work*

THREE hundred delegates represented the 46 member companies of the Kentucky Association of Public Utilities at its twelfth annual meeting at Louisville, January 15 and 16, and 426 gathered at the banquet on Tuesday. The program as carried through ranged around general utility topics, embracing the different classes of companies, but electricity on the farm was the outstanding subject of discussion.

In his presidential address Samuel Riddle described the work of a committee appointed under a resolution of the 1928 Legislature to make a survey of the utilities of the state and suggest remedial legislation if needed. A meeting of this committee was held in November at Louisville, attended by utility representatives, who offered full cooperation and are now compiling information for the use of the committee. A news service bulletin for the use of the press was abandoned early last year, Mr. Riddle said, and Robert Montgomery of the Louisville Gas & Electric Company was made chairman of a special committee to give out publicity.

On Tuesday afternoon Keen Johnson, editor of the Richmond (Ky.) *Register*, spoke on "The Industrial Future of Kentucky," telling of scientific developments aided by electricity. Dean Thomas P. Cooper, of the Agricultural College, University of Kentucky, discussed "What Electricity Means to the Farmer," and G. M. Miller, Louisville Gas & Electric Company, took as his subject "Neon Lighting."

J. F. Owens, vice-president of the National Electric Light Association, was guest of honor at the banquet and spoke on public relations. James P. Barnes, Louisville Railway Company, was toastmaster.

On Wednesday morning N. M. Argabrite, vice-president American Gas & Electric Company, New York, read a paper on "A Fundamental Rate Basis." Prof. Ralph E. Hill, University of Louisville, spoke on education and higher standards of living as developers of the public utilities.

James B. Davis, president Federal Land Bank, Louisville, discussed "Progressive Agriculture with the Aid of the Utilities"; J. H. Harmon, Kentucky Utilities Company, stressed the influence of safety work on industry, and Mrs. B. K. Yewell, chairman of the women's committee, spoke on "Selling the Electric Idea to Women."

Officers elected are: President, W. H. Horton, general manager Cincinnati, Newport & Covington Railway Company; first vice-president, L. B. Herrington, president Kentucky Utilities Company, Louisville; second vice-president, M. C. Funk, Kentucky & West Virginia Power Company, Ashland, Ky.; secretary, E. F. Kelley.

## Detroit Edison's Program

*Thirty Million Dollars Appropriated in Tentative Budget, Including the Two New Generators at Delray No. 3 and New Substations*

ALTHOUGH final decision on the Detroit Edison Company's construction program for 1929 has not yet been reached, preliminary figures total more than $30,000,000 as compared with $29,000,000 last year. The tentative budget includes an appropriation of more than $6,000,000 for Delray station No. 3, where two 50,000-kw. turbines, essentially identical with the six turbines at Trenton Channel, are scheduled to go into service in the early fall. There will then still be room in the first section of the building for one more. Five boilers will be installed, with room for a sixth. These boilers will be stoker-fired with a capacity of 340,000 lb. of steam an hour. They are said to be unique in that they are fired from one side only.

At Trenton Channel there will be a little more work to do in connection with completing the installation of the sixth 50,000-kw. turbine there, and there is also under consideration a scheme to preheat the tertiary air which is mixed with pulverized coal at the burners. A number of comparatively small jobs, any one of which, however, costs what most men regard as a "small fortune," are also scheduled at Trenton Channel. At Connors Creek a new switch house, to cost $2,500,000, may be started late in the year. It would permit the installation of the latest type of oil switches and would meet needs that will arise if an addition to that power house be made.

To protect Port Huron against interruptions of service such as an oil-switch explosion brought about in October, an outdoor switching station is under construction at Marysville, to cost $330,000. This puts the switches on all 24,000-volt overhead lines out of doors and makes it possible to feed Port Huron from the 120,000-volt transmission system, even though the Marysville power house were temporarily off the line.

There are to be three new major substations to be known as (1) West End, on a site north and west of West Jefferson Avenue; (2) Chandler, on the east side of the city, and (3) Ecorse, in the city of Ecorse, probably on the site now occupied by the present Ecorse substation. The West End and Chandler substations are already under way. The Hart, Cortland, Amsterdam and Grand River substations are being rebuilt and modernized at a cost of $3,400,000. At Walker, McGraw, Scotten and Clay 24,000-volt switches will be eliminated by connecting the 24,000-volt cables directly to the step-down transformers, and entirely new 24,000-volt switch houses will be added to Madison, Orchard and Frisbie, similar in design to a switch house added at Cortland during the past year. These new switch houses are quite imposing structures, being seven or eight stories high. The cost of these changes will be in the neighborhood of $3,000,000.

The schedule of underground conduit and cable construction is as extensive as usual, calling for approximately $5,000,000, and overhead lines will involve the expenditure of about $2,000,000, this including 50,000 wooden poles. Gas and minor electrical expenditures complete the budget.

## Great Northern Railway Electrification

### Trains Now Run Through America's Longest Tunnel and Locomotives Haul Equipment on Seventy-five-Mile Stretch, Including Eight-Mile Bore

SATURDAY afternoon, January 12, saw the entire 75-mile route of the Great Northern Railway through the Cascade Mountain range, 100 miles east of Seattle, changed over from steam to electrical operation, including the longest railroad tunnel in America, an eight-mile bore. Passage of the first train through the tunnel was proclaimed to the people of the nation by a radio "hook-up" during which Ralph Budd, president of the railway, spoke from the eastern portal just before the train passed through it; W. W. Atterbury, president Pennsylvania Railroad, from Philadelphia, and President-elect Hoover from Washington, D. C., as the train emerged at the western portal, while Mme. Schumann-Heink sang at San Francisco.

The Great Northern tunnel cost about $14,000,000 and the total expenditure on the electrification project has been approximately $25,000,000. The new Cascade Tunnel is exceeded in length by only four tunnels in the world—the Simplon, St. Gothard, Loetschberg and Mount Cenis tunnels in the Alps. It is nearly two miles longer than the recently opened Moffat Tunnel in Colorado.

The tunnel was driven through the granite backbone of the mountains and lined with concrete in exactly three days less than three years, a record which cuts in half all previous records for speed in the construction of long railway tunnels through mountains.

The electric locomotives for hauling the trains over this 75-mile stretch of electrified line and through the new tunnel are the largest and most powerful of their type. They are also unique, according to engineers of the General Electric Company who designed and built the single-cab type, in that they will utilize the economical advantages of both alternating and direct current. Within the cab of each locomotive is a traveling substation, picking up 11,000 volts alternating current from the overhead trolley wires and changing it to low-voltage direct current for operating the powerful driving motors.

Another feature of these new locomotives is their regenerative braking. On the down grades, when braking is necessary, the motors act as generators and regenerate from 30 to 35 per cent of the power required to move them on the up grade. This current is fed back through the trolley poles into the power lines, helping to move trains on other sections of the electrified section. The regeneration of power also serves as a safe means of control on the down grades, making it possible to reduce the speed of heavy freight trains on the steepest grades from normal to two miles an hour without the use of the air brakes.

The new Cascade Tunnel and the relocation of 20 miles of approach on the east slopes of the Cascades, together with the electrification of the entire Cascade crossing, constitutes, it is declared, the most important project for the improvement of a transcontinental route ever undertaken. Passenger trains will cross the Cascades in one hour's less time while all freight movements will save three hours.

## Niagara Falls Power Company May Erect Wings in River

The engineering plan to preserve scenic beauty by preventing further erosion of the Horseshoe Falls has been laid before Governor Roosevelt of New York by Paul A. Schoellkopf, president of the Niagara Falls Power Company.

Drafted by federal power authorities in co-operation with the Niagara power officials, the project would provide for the erection of concrete wings in the river above the falls to divert a greater flow of the water to the sides of the Horseshoe Falls. By arrangement between the federal government and Canada the plan may be tried over an experimental period of seven years. It is said that the cost would be $150,000, which the Niagara Falls Power Company would foot.

## Portland (Ore.) Electric Companies' Budgets

Electric light and power companies operating in Portland, Ore., and other places in the Pacific Northwest have announced budgets for 1929 which include the following items:

The Northwestern Electric Company's budget for extensions and improvements is $2,225,000. Of this amount $1,250,000 will be expended at the Lincoln Street station for a 20,000-kw. turbo-generator. The second largest single item is $700,000 for extensions and improvements. Preliminary expenditures for the proposed Lewis River hydro-electric project are estimated at $80,000. Other items include $60,000 for increased capacity of substations

and $45,000 for improvements to the plant on White Salmon River.

The budget of the Pacific Power & Light Company amounts to $980,000. Of this amount $350,000 is the largest item, being for extensions to meet increased demands for electric and water service. The next largest item is $100,000 for 20 miles of 66-kv. transmission line from Black Rock, just east of Yakima, Wash., to Coyote Junction, between Priest Rapids and Hanford. This will replace a line leased by the company.

The Inland Power & Light Company, from which the Pacific Power & Light Company leases properties for operation in the Lewiston and Grangeville (Idaho) districts and several districts in Oregon, contemplates expenditures during 1929 of $258,000. The main items are $70,000 for extensions of electric service and $80,000 for a transformer at Hanford, Wash.

## Empire State Men Meet

*Automatic Frequency Control, Airport Problems, Vibration of Conductors, Radio Interference and Other Topics Form Program at New York*

MEETING in New York City on January 10 and 11, with more than a hundred delegates from all parts of the state in attendance, the Electric Section of the Empire State Gas and Electric Association first heard President M. S. Sloan of the New York City companies dwell on the benefits of section meetings.

Following his address a report upon automatic frequency control was read by G. A. Powell, chairman of the operating committee. H. E. Warren, president Warren Telechron Company, described the application of the telechron motor with master pendulum timer for the control of frequency, saying that with it an accuracy within one second per day was common and that it was possible to get an accuracy of one second in ten days. Such accuracies when used in conjunction with the frequency meters which have an accuracy of one-fiftieth of a cycle give virtually a constant frequency. Aerial power cables were discussed in the report of the overhead systems committee (J. F. Werner chairman). Colonel Stedman Hanks, president American Airport Corporation, spoke on the need of electrical power for airport lighting, beacon lighting and warning lights.

A report on vibration of overhead conductors, presented by the transmission lines committee (S. H. Abbey chairman), was the first item in the afternoon session. The radio co-ordination committee (W. L. Wenzel chairman) reported on the generation of radio interference, explaining clearly the causes of many radio disturbances. The discussion ranged around local difficulties, most of which had been corrected, and there was agreement that only about 17 per cent of all complaints investigated can be charged to electric utility companies' systems.

F. G. Schramm, chairman underground systems committee, reported on applications of parkway cable, stressing the fact that laying of cable unprotected by duct lines may cause trouble through workmen breaking these lines or the cable. Such interruptions are difficult to locate, he said, particularly in the case of parkway cable used for street lighting.

The report of the hydraulic power committee (Byron E. White chairman), presented on the second day, covered the relation of rainfall to run-off. It was well prepared, as were the reports of the apparatus and rural lines committees. The paper on rural lines construction, by A. W. Underhill, showed fruitful results from many hours' research

In an able address Charles S. Ruffner, president of the association, stressed the good to be obtained from a free interchange of ideas.

V. J. F. Brain, New York Edison Company, was elected chairman of the managing committee for the ensuing year and S. H. Abbey, Northern New York Utilities, Inc., vice-chairman.

## Briefer News

FLOODLIGHTING IN MIAMI.—The new Dade County Court House at Miami, Fla., is admirably adapted to floodlighting, and projectors have been

installed by the Whitmore Electric Company. They include 40 General Electric form L-24 projectors with clear-glass doors, 48 form L-9 projectors with stippled doors, 40 form L-9 projectors with red doors, and 36 form L-7 projectors with stippled doors, a total of 164 units.

LOS ANGELES BUREAU WILL ALMOST DOUBLE LAST YEAR'S EXPENDITURE FOR EXPANSION.—The Bureau of Power and Light of Los Angeles reports that it added nearly 13,000 to its list of consumers during 1928, power consumption increasing 11.10 per cent. Extensions and betterments costing $5,000,000 were made, including the addition of a fifth unit and penstock at power plant No. 1 and the installation of underground distribution systems in Hollywood and San Pedro. The 1929 budget calls for an expenditure of $9,500,000.

INDIANA UNIVERSITY HAS NEW POWER PLANT.—A program for remodeling and enlarging the Indiana University power house at Bloomington, Ind., is completed. More than $150,000 was spent on the project to equip the university with a 2,000-hp. modern power plant which will meet the heat and electric requirements of the university for several years. Automatic equipment is used wherever possible.

TO PROMOTE ELECTRICAL DEVELOPMENT IN WESTERN MANITOBA.—The Manitoba government is beginning to develop electric service in the western part of the province and has installed a new power plant at Virden, where one unit has been in operation for several years. It is the intention to build extensions from this government plant to supply the surrounding district within a radius of 35 miles.

ELECTRICAL COMMITTEE OF N.F.P.A. MEETS AGAIN ON FEBRUARY 18.—Another meeting of the National Fire Protection Association electrical committee will be held on Monday, February 18, at 10:15 a.m., in the auditorium of the Consolidated Gas Company, 130 East Fifteenth Street, New York, to continue on February 19 and 20. It is expected that the sections of the code covering grounding will be discussed.

ELECTRIC WELDING NOW TAKES IN OIL LINES.—Electric welding has been successfully applied to 220 miles of 8-in. oil pipe lines belonging to the Texas Company and stretching from San Augustine to Corsicana in eastern Texas and from Lefors to Electra in the Panhandle. These are said to be not only the first oil lines ever to be electrically welded but also the first long pipe lines to be so welded. Tests have been made under 900 lb. water pressure with a showing of only about twelve pinhole leaks.

PLANS OF VIRGINIA ELECTRIC & POWER.—The Virginia Electric & Power Company will in 1929 spend $4,000,000 in expanding its system and in additions and replacements, according to William E. Wood, president. Plans are also being perfected for starting construction in the early part of 1930 on the Roanoke River hydro-electric development, which will cost between $7,000,000 and $8,000,000 and have a production of approximately 25,000 kw. With $4,000,000 to be expended for betterments in 1929, an equal amount in 1930 and an additional $7,000,000 or $8,000,000 on the Roanoke River power development, the company's plans call

for a total expenditure of approximately $15,000,000 in the next two years in improving its system in Virginia and North Carolina.

NEW STEAM UNIT FOR ROCHESTER UNDER CONSIDERATION.—Construction of a plant to contain a 25,000-kw. turbo-generator by the Rochester Gas & Electric Corporation, at a cost of approximately $1,000,000, are being considered, but no decision has been reached. If the plant is built, it will be on the west bank of the Genesee River. It would have no effect on the Mount Morris power dam project, company officials state. By the time the dam is completed both plants could be used efficiently, they think.

"DEION" CIRCUIT BREAKER TO COME BEFORE A.I.E.E. MEETING. — Among the most interesting topics to come before the winter convention of the American Institute of Electrical Engineers, of which the program was printed on page 116 last week, is the development known as the "Deion" circuit breaker, so named because it utilizes a different method from any heretofore employed in commercial circuit breakers for opening alternating-current circuits to deionize the arc stream and thus interrupt the circuit in air. The device, which is of Westinghouse manufacture, is a breaker of high interrupting capacity, not employing oil as an arc-interrupting medium.

NORTH CENTRAL N.E.L.A. TO HOLD RURAL SERVICE CONFERENCE.—Following a week after the meeting of the Engineering Section of the North Central Electric Association, which begins on Monday next, there will be a rural electric service conference of the same body—also at the Nicollet Hotel, Minneapolis—on January 28 and 29. C. F. Stuart, E. A. White, F. S. Rice, B. E. Miller and John Pike will give papers; E. A. Stewart will present the Red Wing report, and there will be discussions on two general subjects—"Developing Appreciation of the Possibilities of Farm Service" and "Selling Equipment to the Farmer." Dean W. C. Coffey of the College of Agriculture, University of Minnesota; John F. Reed and Robert F. Pack will speak at the banquet.

ARTISTIC LIGHTING EQUIPMENT MEN TO MEET AT NORFOLK.—Virginia Beach at Norfolk, Va., will be the meeting place for the annual gathering of the Artistic Lighting Equipment Association and the Illuminating Glassware Guild on February 6, 7 and 8. Among the speakers listed are the president, George J. Klein; T. Yeoman Wilkins, whose subject will be the lighting equipment industry and union labor; A. L. Powell, on the value of the lighting school, and Charles T. Abbott, on the work of trade organizations. Discussions on credits and collections, how to cut costs with a cost system and how to reduce the cost of distribution are scheduled, as well as committee reports, group meetings and a banquet on Thursday evening.

QUEBEC COMPANY HAS PLAN TO DEVELOP 2,800,000 HP.—An application will be made at the forthcoming session of the Canadian Parliament on behalf of the Great Lakes & Atlantic Canal & Power Company, which seeks to develop 2,800,000 hp. of electrical energy in the Province of Quebec. The company's proposed development is from Hungry Bay, near Valleyfield, to La Prairie Basin, where a canal would be built to connect with the Richelieu River. The details were recently outlined by James M. Robertson, consulting engineer of Montreal, who asserted that the company would eventually be in a position to supply power to the Ontario Hydro-Electric Power Commission at $12 per horsepower.

## *Coming Meetings*

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for January 5, page 80.]

North Central Electric Association — Engineering Section, Minneapolis, Jan. 21-22; Commercial Section, Minneapolis, Feb. 25 and 26. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

National Electrical Manufacturers' Association — Supply Division, Hotel Commodore, New York, Jan. 21-26. S. N. Clarkson, 420 Lexington Ave., New York.

American Institute of Electrical Engineers—Winter convention, New York, Jan. 28-Feb. 1; regional meeting, Cincinnati, March 20-22; regional meeting, Dallas, Tex., May 7-9. F. L. Hutchinson, 33 West 39th St., New York.

Artistic Lighting Equipment Association and Illuminating Glassware Guild—Cavalier Hotel, Virginia Beach, Norfolk, Va., Feb. 6-8. G. P. Rogers, 420 Lexington Ave., New York.

Pennsylvania Electric Association—Commercial Section, Schenley Hotel, Pittsburgh, Feb. 7. H. A. Buch, Telegraph Bldg., Harrisburg, Pa.

Midwest Power Conference — Chicago, Feb. 12-16. G. E. Pfisterer, 53 W. Jackson Blvd., Chicago.

New England Division, N.E.L.A.—Engineering Section, Hotel Statler, Boston, Feb. 13-14. Miss O. A. Bursiel, 20 Providence St., Boston.

New Mexico Utilities Association — Franciscan Hotel, Albuquerque, Feb. 18-20. Bernard L. Wiles, Albuquerque Gas & Electric Company, Albuquerque, N. M.

Iowa Section, N.E.L.A.—Operators' Section, Sioux City, Feb. 26-27. H. E. Weeks, Davenport, Iowa.

Oklahoma Utilities Association—Oklahoma City, March 12-14. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Arizona Utilities Association—El Conquistador Hotel, Tucson, April 18-20. Lee C. McCullough, 134 South Central Ave., Phoenix.

Middle West Division, N.E.L.A.—Hotel Fontenelle, Omaha, Neb., April 24-26. T. A. Browne, Lincoln, Neb.

Southwestern Division, N.E.L.A. — Arlington Hotel, Hot Springs, Ark., April 30-May 3. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Southwestern Public Service Association—Hot Springs, Ark., April 30-May 3. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Arkansas Utilities Association — Arlington Hotel, Hot Springs, Ark., April 30-May 3. R. I. Brown, Arkansas Power & Light Co., Little Rock, Ark.

Southeastern Division, N.E.L.A.—Asheville, N. C., May 8-10. C. M. Kilian, 207 Bona Allen Bldg., Atlanta.

National Electrical Wholesalers' Association—The Homestead, Hot Springs, Va., May 27-31. E. Donald Tolles, 165 Broadway, New York.

FIVE HUNDRED BEST UTILITY ADVERTISEMENTS COLLECTED.—J. C. Barnes, New Orleans Public Service, Inc., who is president of the Public Utilities Advertising Association, has announced that a portfolio containing 500 of the best public utility advertisements in the past year is off the press. This portfolio is divided into eight parts, among which are sections on central-station institutional advertising, commercial advertising, customer-ownership financial advertising and advertising for the benefit of the industry as a whole.

INDIANA & MICHIGAN ELECTRIC TO ERECT NEW OFFICE BUILDING IN SOUTH BEND.—Plans for a five-story stone and terra-cotta office building at South Bend, Ind., for the Indiana & Michigan Electric Company have been announced by Thomas P. English, vice-president. The new building will be constructed on the site of the present one on West Colfax Avenue. It will cost about $208,000. Construction will begin in March and the building will be ready for occupancy in November. It will be so constructed that two additional stories may be erected.

MEXICO TO HAVE ANOTHER LARGE HYDRO PLANT.—Following the recent purchase through the Electric Bond & Share Company of the holdings of the Tampico Electric Company and other large electric light and power interests in Mexico, a statement by L. P. Hammond, vice-president of the first-named company, says that a 50,000-hp. hydro-electric plant will be erected at the Micos Falls, in the State of San Luis Potosi. Construction will be started in February. Transmission lines will be constructed to San Luis Potosi, Monterey, Saltillo, Mexico City, Tampico and a number of smaller communities and mining districts. The cost of the project will be approximately $10,000,000.

MISSOURI UTILITIES COMPANY LOWERS RATES.—The Missouri Utilities Company of St. Louis has filed with the Public Service Commission schedules of reduced rates applying to the 23 cities and towns in southeast Missouri, including Cape Girardeau, Chaffee, Charleston, Dexter and Sikeston. The maximum domestic rate for the first 20 kw.-hr. per month in the smallest towns is 13 cents and in the large towns and cities 9 cents. The second and remaining blocks are the same in all towns served, being 6 cents for the second 20 kw.-hr. and 3 cents for all in excess. These rates are regarded as among the lowest in the state. Poplar Bluff, one of the largest places on the company's circuit, was not included in the new rates as scheduled, but the company has

announced that it also will get the reduction. The Poplar Bluff municipal plant has just cut its rates 10 per cent or more, offering 20 kw.-hr. at 8 cents and energy in excess of that at 6 cents.

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PUBLIC SERVICE OF COLORADO TO SPEND $3,600,000 FOR IMPROVEMENTS.—The Public Service Company of Colorado will spend $3,600,000 during 1929 for plant improvements. Half a million dollars will be used to increase steam boiler capacity at the Valmont plant. Additional machinery will be installed at the company's four hydro-electric plants at Boulder, Shoshone, Georgetown and Marysville, to cost about $250,000. Enlargement and improvement at Leadville will cost another quarter million. The rest will go for extensions of the transmission system, substations and small undertakings.

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OHIO UTILITIES TO SPEND $100,000,000 IN 1929.—More than $100,000,000 will be spent this year by Ohio public utility companies for the purpose of continuing, improving and extending electric light and power, gas, telephone and electric railway services, it is estimated by the Ohio Committee on Public Utility Information. The expenditures planned by the larger light and power companies include: Columbia Gas & Electric Corporation, Cincinnati, $12,000,000; Cleveland Electric Illuminating Company, $11,000,000; Pennsylvania-Ohio Power & Light Company, Youngstown, $4,035,000; Toledo Edison Company, $3,691,184; Northern Ohio Power & Light Company, Akron, $2,513,685; Ohio Public Service Company, Cleveland, $1,128,436; Ohio Edison Company, Springfield, $639,275; Columbus, Delaware & Marion Electric Company, $600,000.

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NEW GORGAS PLANT OF ALABAMA POWER TO BE FINISHED THIS YEAR, LOWER TALLASSEE NEXT, JORDAN DAM AT WORK.—Seventeen million dollars will be expended by the Alabama Power Company in 1929 under construction and operating budgets just completed, President Thomas W. Martin announces. The major projects are the completion of the new Gorgas steam plant on the Warrior River, with an initial installation of 80,000 hp., and the reconstruction of the Lower Tallassee development, with an initial capacity of 84,000 hp., scheduled for completion in July, 1930. Other items are additions to substations, high-tension transmission lines and distribution. On January 1 the Jordan Dam hydro-electric plant, on the Coosa River, was formally turned over to the operating department. In both initial and ultimate capacity it is the largest of the company's hydro developments. The four turbo-generators, rated at 36,000 hp. each, are said to develop 40,000 hp. under the operating head of 93 feet, giving the plant a present capacity of 160,000 hp. Provisions for the later installation of two units of the same size will permit an ultimate capacity of 240,000 hp.

## Supreme Court Finds Against Chicago Sanitary District

Suits brought by Wisconsin and five other states against Illinois and the Chicago Sanitary District to prevent the continued diversion of 8,500 sec.-ft. of water from Lake Michigan into the Drainage Canal were decided by the United States Supreme Court on January 14 against the defendants. This finding confirms the report made on November 23, 1927, by Charles E. Hughes, acting as special master. The motion of Missouri and other states on the Mississippi which sought to intervene was dismissed. The Supreme Court said:

In increasing the diversion from 4,167 sec.-ft. to 8,500 sec.-ft. the Drainage District defied the authority of the national government; and in so far as the prior diversion was not for the purpose of maintaining navigation in the Chicago River it was without any legal basis, because made for an inadmissible purpose. It therefore is the duty of this court by an appropriate decree to compel the reduction of the diversion to a point where it rests on a legal basis and thus to restore the navigable capacity of Lake Michigan to its proper level. . . . Though the restoration of just rights to the complainant will be gradual instead of immediate, it must be continuous and as speedy as practicable.

In granting time to Chicago to carry out the decree, which is of especial interest to the electric light and power industry because of its bearing on the water power of rivers fed from the Great Lakes, the Supreme Court had in mind the danger to public health in Chicago by the sudden upsetting of its sanitary system. To determine the practical measures necessary to effect the object of the decision and the period required for their completion the case was again referred to Mr. Hughes as master, for the hearing of expert testimony. It seems certain, however, that Chicago must recede from her stand.

# Recent Court Decisions

MUNICIPAL ELECTRICAL DEPARTMENT IN CONNECTICUT MAY SELL APPLIANCES.—The Connecticut Superior Court has decided, in Brown vs. City of Norwich, that the city's gas and electric department has the right to sell appliances despite the fact that a special city meeting voted against approving the practice. The judge said: "The only matter that I have before me is a matter of law, whether the city of Norwich is prohibited under the charter from doing those things that I take it are incident to conducting a light and power plant. Now private plants—take it in New London, Waterbury, New Haven—sell appliances to the consumer to use electricity, and this case, while, of course, it is not an identical case, seems to hold the same way, that the right to sell electricity and furnish heat and power to the city carries the right to sell appliances to use the electricity itself. It seems to me that is what a private company does."

UTAH COMMISSION DEPRIVED OF POWER OVER MUNICIPAL PLANTS.—The Supreme Court of Utah has held, in Logan City vs. Public Utilities Commission of Utah, that, assuming a municipal utility plant to be subject to the control of the commission, a rate fixed by that body, which was the same as that of a competing private utility, without any determination that this rate was "fair and reasonable," or whether a lower rate would or would not meet the city's requirements, was not properly imposed. The court, however, also found that the clause of the Utah public utilities act giving the commission authority over municipal plants was in conflict with the state constitution. The court therefore annulled the order of the commission so far as it relates to the municipal plant of Logan City. This commission ruling was recorded in the ELECTRICAL WORLD for March 3, 1928 (page 476). (271 Pac. 961.)*

# Commission Rulings

ELECTRIC DEPARTMENT OF UTILITY CANNOT BE ALLOWED TO BEAR ITS STREET-RAILWAY LOSSES.—The Pennsylvania Public Service Commission holds that the fact that the electric department of the Northwestern Electric Service Company of Pennsylvania, a company operating both an electric plant and a street railway, is operating at a profit is not a bar to the abandonment of a portion of the street railway being operated at a loss. Says the commission: "Persons securing electric service from the applicant company cannot be required to bear the cost of furnishing street-railway service to the protestants. Reference was made to the fact that electric wires are carried on the poles of the railway department and no income is received therefor. This might be material if the applicant were claiming the right to earn a fair return upon the value of the poles which are jointly used, but is immaterial in view of the fact that the revenues do not produce any return upon the investment nor meet all the operating costs."

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POSSIBILITY OF LOSS OF REVENUE BY CLOSING OF ILLEGAL RESORTS CANNOT BE FACTOR IN RATE CASE.—Before the Nevada Public Service Commission the Ely Light & Power Company, in arguing that its profits were not too great, alluded to the alleged fact that, in addition to the hazards usually associated with business in a mining camp, a large portion of the revenues of the company is derived from "saloons and gambling halls" and that there is an uncertainty of continuance of this source of revenue because of the illegal nature of the business supplying the revenue and the possibility of actual enforcement of existing laws at some time in the future. The commission refused to be impressed by this argument, saying: "The facts before us are that the Ely Light & Power Company is earning a certain revenue from the sale of electrical energy to the public generally, and we have no specific information to indicate that any large portion of the consumers are conducting an illegal business, liable to be suspended or prohibited by law enforcement officers, and we can consequently give no consideration to this particular point in counsel's argument."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

## *G. M. Gadsby to Join Electric Bond & Share Company*

George M. Gadsby, president of the West Penn Power Company, has resigned to become associated with the Electric Bond & Share Company of New York. Mr. Gadsby has been identified with the West Penn system in Pittsburgh since 1918, when he removed from Arkansas as assistant to the president

*G. M. Gadsby*

of the West Penn Power Company, A. M. Lynn. In less than a year he was promoted to the position of vice-president and after nine years of service in this executive office he was named president.

He obtained his first practical engineering experience as chemist with the water department at Marietta, Ohio, and, following graduation from the Massachusetts Institute of Technology in 1909, he was employed as chemist for the Warren Water Company, a subsidiary of the American Water Works & Guarantee Company at Warren, Pa. From there he went to Pittsburgh, subsequently to Little Rock, Ark., and later to New York. Two years later—in 1917—Mr. Gadsby returned to Little Rock to engage in business, but before he had established himself he was requested to return to Pittsburgh as Mr. Lynn's assistant.

While engaged in public utility work in Pennsylvania he has been very active in association affairs, being a past-president of the Pennsylvania Electric Association, organizer of its first commercial section and chairman of that section for three years. He has also acted for two years as chairman of the special power survey committee representing the association in work with the "giant power" survey board and work in conjunction therewith by the Public Service Commission.

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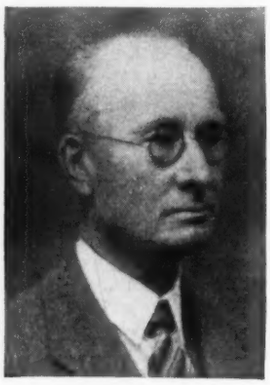
W. S. Robertson has been appointed President of the Minnesota Power & Light Company to succeed C. E. Groesbeck, who resigned. Mr. Robertson has been vice-president and general manager of the company since it was organized in 1923. Mr. Groesbeck will continue as president of the American Power & Light Company of New York.

## *Edward Anderson Heads Winnipeg Company*

Edward Anderson, K. C., has been appointed president and general manager of the Winnipeg Electric Company and its subsidiaries to succeed A. W. McLimont, who has retired because of ill health. Mr. Anderson is, to all intents and purposes, a Manitoba product, having left his birthplace, Dorchester, Que., at the age of twelve to make his new home in Portage la Prairie in 1879. After attending the public schools he was graduated from Manitoba University and was called to the Manitoba bar in 1889. For several years he was Crown Prosecutor at Portage la Prairie and in 1906 became associated in Winnipeg with the legal firm of Moran, Anderson & Guy. In 1909 he was made a K. C. and during the same year became associated with the legal department of the Winnipeg Electric Company. He has served as president of both the Manitoba Bar Association and the Manitoba Law Society, as well as taking an active interest in public affairs generally.

During the twenty years that Mr. Anderson has been connected with the Winnipeg Electric Company he has actively participated in the many important developments that the company has promoted during that period and he steps into office at the commencement



*Edward Anderson*

of the greatest development the company has yet undertaken—the 225,000-hp. hydro-electric plant at Seven Sisters Falls on the Winnipeg River.

At the meetings of the boards of directors Mr. Anderson was also elected a director of the company and associated companies.

## *H. L. Mitchell Succeeds Gadsby in Pittsburgh*

Harry L. Mitchell, president of the West Penn Railways Company since 1927, was elected president of the West Penn Power Company at a meeting of the board of directors, to succeed G. M. Gadsby, resigned. Mr. Mitchell has been identified with West Penn operations for more than 25 years.

*H. L. Mitchell*

Up to this time he has been best known as a railway executive and it is in this field of endeavor that his accomplishments have been remarkable. During his association with the West Penn Railways the property has developed into one of the most important utility systems in Pennsylvania and that position has been reached largely through his efforts.

Entering the employ of the Pittsburgh, McKeesport & Connellsville Railway Company in 1922, he advanced consistently in the ranks, and when in 1911 the West Penn acquired additional lighting and railway properties Mr. Mitchell was transferred from Connellsville to Pittsburgh as assistant to W. E. Moore, then vice-president and general manager. From 1915 to 1918 he served as assistant manager of the light and power department, and after serving as vice-president and manager of the Wheeling Traction Company of Wheeling he returned to Pittsburgh as general manager of the West Penn Railways. Not long after he became vice-president and finally president.

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E. W. Fowler has been appointed general manager of the Northern Illinois group of properties of the Illinois Power & Light Corporation. Mr. Fowler started his career with the Illinois Traction Company in 1906 in Ottawa, later removing to Peoria, Ill. During recent years he has held the position of assistant vice-president of the Illinois Power & Light Corporation with headquarters in Chicago.

## *Robertson New Chairman of Westinghouse Board*

Andrew W. Robertson, who was elected chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, as announced in the News Department of the ELECTRICAL WORLD, is president of the Philadelphia Company and its subsidiary, the Duquesne Light Company, with headquarters in Pittsburgh. Mr. Robertson grew up in that city and is thoroughly familiar with the institutions and ideals which have made it a great industrial and cultural center. His connection with the public utility industry

*A. W. Robertson*

dates back to 1913, when, after several years of general law practice, he became attorney for the Pittsburgh Railways and the Duquesne Light Company. In 1918 he was named general attorney for the Philadelphia Company and affiliated corporations and five years later was elected vice-president in charge of public relations, retaining also his position as general attorney. His experience in this executive position brought him in close contact with the public, and so capably and amicably did he perform these exacting duties that when A. W. Thompson resigned the presidency of the company in the summer of 1926, Mr. Robertson was considered to possess all the qualifications necessary to fill this important position.

Mr. Robertson will sever his connection with the Pittsburgh utilities and will withdraw from other business activities to devote his entire time to the Westinghouse company. A statement issued by the executive committee of the Philadelphia Company said in part: "As president of the Pittsburgh utilities, Mr. Robertson has filled a position of great responsibility and he will go splendidly equipped for new achievements in the career of one of Pittsburgh's foremost industrial enterprises." He is a member of the American Institute of Electrical Engineers, the American Gas Association and the American Railway Association.

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WILLIAM INSULL, manager at Lafayette, Ind., for the Northern Indiana Public Service Company, has resigned to affiliate himself with the National Electric Power Company, with offices in New York City. He has been manager at Lafayette for the past four years. Before assuming the managership of the Lafayette district in 1924, Mr. Insull was associated with the Interstate Public Service Company at Connersville, Ind.

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## *A. W. McLimont Resigns*

A. W. McLimont, director, president and general manager of the Winnipeg Electric Company, Winnipeg, Man., and associated companies, has resigned because of ill health. Mr. McLimont's physicians advised him that if he was to avoid serious complications and perhaps a complete breakdown he should arrange to be relieved of his responsibilities and as soon as possible take a long rest and vacation of possibly a year's duration. In the course of his career in the public utility field Mr. McLimont served as electrical engineer for the Public Service Commission of the First District of New York and has held other important positions in the United States. He also constructed and operated electric systems in South America and Mexico. He had been general manager of the Winnipeg utility for approximately eleven years. The following tribute was contained in the official statement: "The board wishes to express its appreciation of Mr. McLimont's outstanding services to Winnipeg Electric Company, Manitoba Power Company, Ltd., and associated companies during the past eleven years. His ability and the results of his efforts are too well known in Greater Winnipeg and, in fact, throughout Canada, to require laudation at this time."

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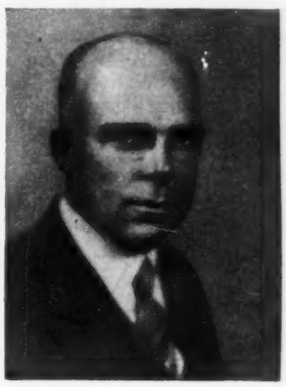
THOMAS A. EDISON left his home in West Orange, N. J., January 15 for his winter home in Fort Myers, Fla., where he will remain until May.

DR. EUGENE C. SULLIVAN, president of the Corning Glass Works, Corning, N. Y., has been awarded the Perkin medal for pioneer work in the development of scientific control and production in the glass industry. Other of Dr. Sullivan's achievements include the production of highly uniform glass for machine manufacture of incandescent lamps, the development of transparent, heat-resisting glasses and the evolution of an extensive series of colored glasses having unique transmission values. During the past year he was awarded jointly with William C. Taylor the Howard N. Potts gold medal by the Franklin Institute for his work on super-resistant glasses. He has been associated with the Corning Glass Works since 1908, when he became chief chemist. In 1920 he was made vice-president in charge of manufacturing, assuming the duties of chief executive last year. Dr. Sullivan is a member of the American Chemical Society, the American Institute of Chemical Engineers and the American Electrochemical Society.

## *R. M. Gates Elected to Vice-Presidency*

Robert M. Gates, manager of the industrial department of the Superheater Company, has been elected vice-president of that company. Mr. Gates became affiliated with the company in 1922 and has since been actively engaged in directing the engineering and sales of superheaters for stationary power plants and special pipe coils for the oil and other industries. Mr. Gates is a native of Iowa. Following his graduation from the school of engineering, Purdue University, in 1907, he served as a special apprentice on the Pennsylvania Railroad



*R. M. Gates*

and with the Browning Engineering Company of Cleveland, Ohio, until 1910. The next few years he maintained his own engineering office in Cleveland and later was associated with the Thew Shovel Company, Lorain, Ohio. He then became manager for the Lakewood Engineering Company of Cleveland.

Mr. Gates has taken a prominent part in the activities of the American Society of Mechanical Engineers. For the past two years he has been chairman of the committee of meetings and program, and at the last general election he was made a member of the council of that society. He is a member of the Engineers Club (New York) and of numerous national professional organizations.

# Obituary

FRANCIS R. WELLER, consulting engineer, died January 13 at his home in Washington, D. C. Mr. Weller was active in the practice of his profession as civil and electrical engineer for 25 years and was the organizer of several utility companies in the South. At the time of his death he was president of the Allied Utilities Company, the North Alabama Utilities Company, the Mississippi Gas Company and the Consumers Gas Company. He was a member of the American Institute of Electrical Engineers, the American Society of Civil Engineers and of other professional associations.

# Financial and Statistical News

## Security Prices Continue Firm But Irregular

*Tighter Money Seems in Prospect, but Little Indication Exists of Definite Policy*

THE security markets in general are not quite so buoyant as year-end forecasts indicated. Demand is running more to specialties since the first of the year and the volume of trading is not so impressive as was the case a few weeks ago. More attention seems to be paid to the credit situation and the money rate has, if anything, more control. An interesting comment on the situation is made by the National City Bank:

There is no apparent reason for thinking that conditions in the money market in the coming year will be fundamentally different from what they have been in the past eight months. The supply of bank credit is dependent upon the gold reserves, and gold will not come to the United States from other countries unless interest rates are high enough to make this the best place to employ money. Other countries will resist attempts to take gold from them, and will bid against us for new supplies. This is enough to indicate that we will not have cheap money unless something happens to release credit in this country, such as a decline of general business activity or a decline of prices in the stock market.

Business is unusually promising, and if it comes up to expectations will want increasing supplies of credit. There is still plenty of optimism in the stock market and probably more credit will be wanted in that quarter. A period of relaxation always follows the beginning of the new year, dividend and interest disbursements will be larger than usual this time, and doubtless considerable liquidation will occur.

The feature of the week as far as the utility market is concerned was the trading in the shares of the new United Corporation. Following a large volume of transactions at varying prices on Wednesday, the latest quotation for units of one common and one $3 preference share was 92 bid, 94 asked, contrasting with an offering price of 75 a unit. American Superpower, one of the largest holders of the common stock of the United, both A and B, advanced about ten points during the week.

## Output of Metropolitan District Up 11.6 per Cent

The generating station net output of electric energy of the five companies serving in the metropolitan district reached a new high total of 4,211,000,000 kw.-hr. in 1928, according to Matthew S. Sloan, president of the New York Edison and affiliated electric companies. The 1928 figure is 11.6 per cent greater than that of 1927, when the output of these companies was 3,782,000,000 kw.-hr., and reflects the steady growth in the use of electrical service throughout the greater city.

The 1928 instantaneous peak load for the system, which means the maximum demand for current at any moment during the year, reached a new high total of 1,146,128 kw. (1,535,000 hp.) on Dec. 20 at 5 p.m. This demand was equal to the energy required by the use at the same instant of 23,000,000 50-watt lamps.

## Security Sales in 1928 Total $9,427,013,697

Securities amounting to $9,427,013,697 were bought by the American public through regular banking channels in 1928, according to a compilation made by Stone & Webster and Blodget, Inc., including $7,845,003,797 domestic bonds and stocks and $1,582,009,900 foreign securities. The survey showed a remarkable increase in purchases of stocks, compared with bonds. Bonds sold in 1928 amounted to $6,136,574,693, as compared with $8,067,940,000 in 1927, while stocks amounted to $3,290,439,004, compared with $1,736,750,000.

The sale of domestic securities in 1928 comprised $4,698,909,943 of bonds, $1,379,177,169 of preferred stocks and $1,766,916,685 of common stocks. The increase in stock issues as compared with bonds did not extend to foreign securities, figures for the year being $1,437,664,750 of bonds, $61,530,000 of preferred stocks and $82,815,150 of common stocks.

## Energy Output Booming

Electric energy output in various parts of the country continues to increase rapidly. Engineers Public Service Company reports 73,822,000 kw.-hr. as the December output of its subsidiaries, not including the Puget Sound Power & Light Company, which was acquired during the month. This is 14.4 per cent greater than the December, 1927, amount of 64,538,722 kw.-hr. The American Gas & Electric Company reports an output of 65,756,423 kw.-hr. by its subsidiaries for the week ended January 5, an increase of 9 per cent over the corresponding period last year.

## Detroit Edison to Increase Capital Stock

At the annual meeting of Detroit Edison Company on February 4 stockholders will be asked to approve an increase in authorized capital stock from $120,000,000, of $100 par value, to $150,000,000. It is not proposed to issue the additional stock at present, but merely to provide a sufficient amount of unissued stock to take care of possible future financing through capital stock.

## Georgia Company Experienced Steady Expansion During Past Year

A REVIEW of the past year reveals that the Georgia Power Company enjoyed steady expansion and that great progress was made along the line of servicing smaller communities and developing rural service lines throughout the state. During the year two important mergers were made, the Georgia Power Company absorbing the Macon utilities companies at Macon, Ga., as well as the utilities controlled by the Augusta-Aiken Railway & Electric Corporation, Augusta, Ga. As a result of these mergers and other expansion the number of cities served by the company increased during the year from 155 to 221.

An increase of more than 40,000 customers for the company was noted during the year. On January 1, 1927, there were 83,637 customers buying electric service and 43,521 customers buying gas service from the company. While on January 1, 1928, the number of customers buying electric service was 120,283 and the number of customers purchasing gas service was 51,269.

Among the most important achievements during the past year, according to Preston S. Arkwright, president of the company, was the splendid start made on rural electrification work.

The first rural power line was cut in on June 2, 1927, the Harrison rural line, serving 46 customers; rural lines have been cut in at the rate of two a month, until today there are eleven rural lines, extending 37.5 miles and serving approximately 375 customers. Other rural lines have been authorized by the company and contracts have been let for the construction of some of these lines during this year.

The largest single piece of construction work done was completion of track, steam line, gas main and cable construction on the new Atlanta viaducts. Substations were enlarged and constructed at Atlanta, North Atlanta, East Point, Lindale, Porterdale, Milledgeville and Elberton, while transmission and distributing lines were constructed during the year in numerous cities.

On the whole, the year was one of steady expansion for the Georgia Power Company in extending and strengthening its service to customers in all parts of the state.

# Seasonal Decrease in Manufacturing Operations

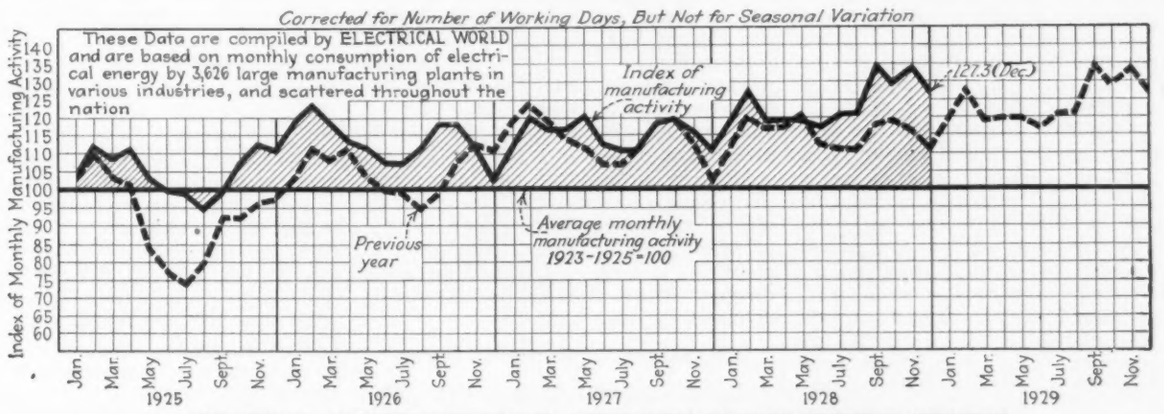
THE manufacturing plants of the nation closed the year 1928 with a rate of operations about 16 per cent over December of 1927, consumption of electrical energy indicates. The closing month of the year witnessed a decrease in the rate of operations of 4.5 per cent as compared with the November activity, very close to the normal seasonal decrease established during past years. The high point of manufacturing activity for the year as well as for past years was in September, since which month there has been a downward tendency, but of less than normal dimensions. The December rate of operations in 1927 was 7.3 per cent under that of the previous September, while in 1928 the seasonal decrease during the same period was only 5.4 per cent. The average rate of operations during 1928 was 7.3 per cent above 1927. Unusually high productive operations as compared with December, 1927, were recorded by chemicals and allied products, the rolling mills and steel plants, ferrous and non-ferrous metal-working plants and the stone, clay and glass industrial groups. Textiles, which during the first part of the year recorded a material curtailment in operations, ended the year with a rate of operations 12.5 per cent over December, 1927.

On the other hand, two of the primary industrial groups—leather products, and lumber and its products—closed the year with a rate of operations under those of December, 1927.

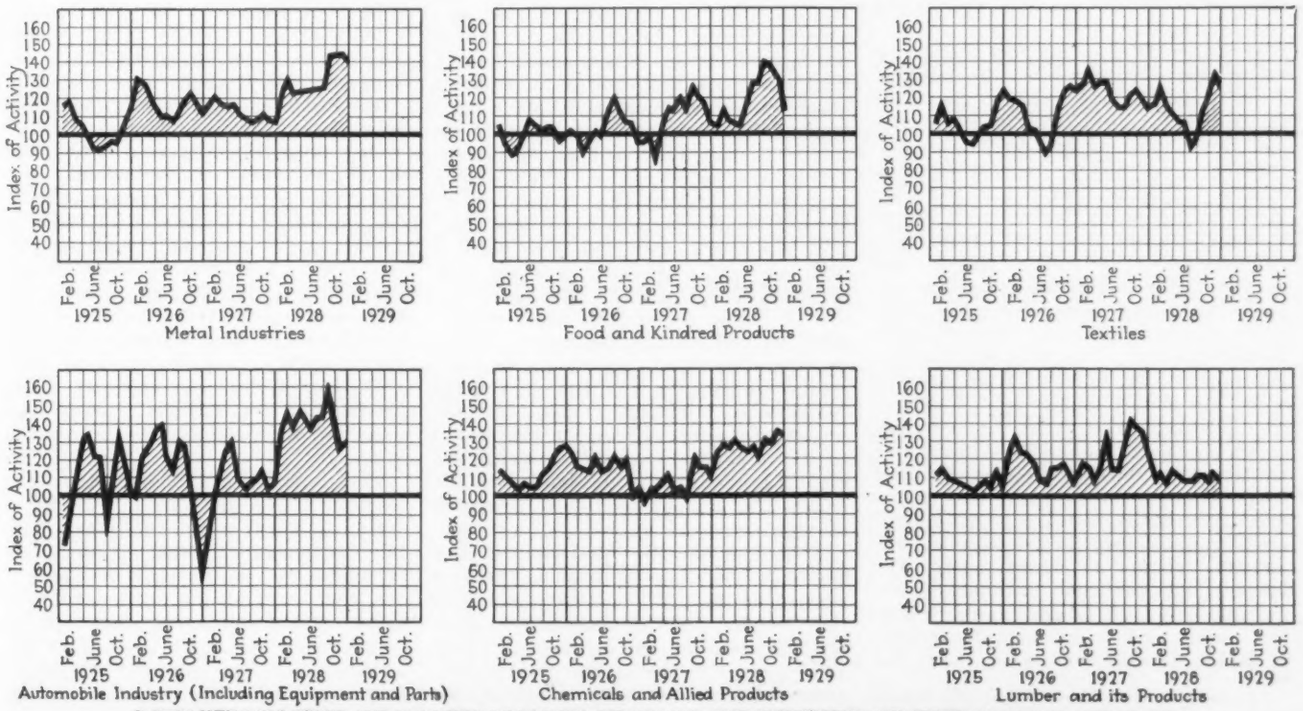
Every section of the nation reported seasonal decreases in rate of operations during December as compared with November, but every section of the country with the exception of the Southern states reported December operations materially over those of December, 1927. December manufacturing operations in New England were 15.8 per cent greater than in the same month in 1927, due very largely to the record of operations being reported by the metal-working plants of the section. Manufacturing plants in the Middle Atlantic states reported operations 15.4 per cent greater than in December, 1927. The North Central states showed a gain of 24.2 per cent, due to the continued comparatively high operations of the automobile manufacturing plants, and the Western states reported a gain of about 11.1 over the year previous. General manufacturing activity in the South was 5.3 per cent under December, 1927.

## Allis-Chalmers Offers Rights

Stockholders of the Allis-Chalmers Manufacturing Company of record of Janaury 25 will have rights to subscribe to 26,000 additional shares in the ratio of one new share at $140 for each ten shares held. The rights will expire on February 20. At the current market price of $189 a share, the rights are valued at approximately $4.50 each.


Corrected for Number of Working Days, But Not for Seasonal Variation
These Data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,626 large manufacturing plants in various industries, and scattered throughout the nation
Index of manufacturing activity
127.3 (Dec.)
Previous year
Average monthly manufacturing activity 1923-1925=100
Index of Monthly Manufacturing Activity
1925
1926
1927
1928
1929

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES




ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

# Utility Financing Involves Frequent Capital Additions*

## This and the Larger Initial Outlay Required Differentiate Public Service Companies from Other Branches of Industry

By Phillip G. Gossler
*President Columbia Gas & Electric Corporation*

THERE are two basic characteristics of public utility operations which do not apply to other business enterprises generally: First, the very large investment required in proportion to the annual income, and, second, the essential requirement of continuous growth, which involves correspondingly increased investment from year to year, which must be provided largely through new capital.

Public utilities (and railroads) are extreme examples among large business operations in this matter of capital turnover, as even the most efficiently managed public utilities average a turnover of their capital employed only once in each four to five years. This means that for each dollar of annual gross revenue received the public utilities have from four to five dollars of capital invested. Or, in other words, in order to realize a return of 10 per cent per annum on the capital employed, a public utility company must have a margin of 40 per cent to 50 per cent of its gross earnings left over after its operating expenses, whereas companies in other lines of business may realize, through frequent turnovers each year, an equal return on their capital through a net earning as low as 5 per cent of gross or less. This is a fundamental economic factor which cannot be materially altered. In each of the various lines of business enterprise the limitations of this factor must be recognized and accepted.

When we come to consider the second factor above referred to, the requirement of continuous growth, the comparison between public utility companies and other lines of business is no less striking. In many enterprises the capital originally invested is the only direct outlay on the part of stockholders to begin the business and carry it on indefinitely in increasing volume and success. This is because the profits are sufficient to pay satisfactory cash dividends, and in addition provide such further capital as is required for expansion of the business from year to year. As a notable example, I believe the United States Steel Corporation, which is, as you undoubtedly know, one of the very largest of the business corporations in the world, has never asked its shareholders to provide additional capital since the corporation was formed, about 27 years ago. The business has increased enormously, requiring new and larger plants, which have been built from surplus earnings of the business after payment of interest and dividends from year to year. This procedure is what is expected generally from industrial enterprises throughout the country, excepting where expansion becomes desirable more rapidly than can be provided from earnings and where expected profits justify the enlargement of permanent capital through additional stock issues.

In the case of public utility companies, however, additional capital is a continuing requirement which never ends. This is due to several factors, including (a) the very large investment in proportion to gross revenue, as previously explained; (b) the constant enlargement of the service with the community growth and increased utilization of its service, and (c) the limitations placed by public authorities upon the charges for service, whereby they are restricted to necessary operating and maintenance expenses, plus a fair return upon the capital investment.

Having outlined the constant necessity for large capital outlays in public utility operations, it may now be appropriate to discuss the character of securities and the methods of financing through which this capital is usually obtained.

### Character of Security Issues

Capital seeks that form of expression in the way of stock and bond issues that has the greatest market value. In endeavoring to procure capital this principle, which is ever at work, should not be underrated. The investor who is content with a low rate of interest but wants absolute security will take a bond bearing 4 per cent or 5 per cent interest provided that there is back of his investment a large equity. The investor who desires a somewhat larger return, but still is not willing to run a very great risk, will buy a preferred stock entitled to 5 per cent, 6 per cent or 7 per cent preferential dividends, provided that there be some equity back of his investment, as evidenced by earnings in excess of the preferred dividend requirements. Finally, there is that class of investor who is willing to take a chance for larger profits. The saving that is due to the application of this principle of classification benefits the holder of the equity and belongs to him as a matter of right.

Prominent among the factors that have contributed to the rapid and healthy growth of the utility industry has been the so-called holding companies. With the development of engineering skill and improved mechanical equipment, great advance has been made in the efficient production of electric energy and gas, in large quantities, and in their transmission over long distances over wires or through pipe lines. All this has tended to development of larger and larger units of both gas and electric production. As these production units have exceeded in capacity the demands of the community in which they are located, it has been possible to extend the transmission of their product, and many of these big producing units have been interconnected into large systems, providing flexible supplies of power and heat over vast areas. The financing required for such large developments has, however, far exceeded the resources of the cities and communities supplied, and recourse therefore had to be taken to the principal money markets of the country and the world, and to collect and invest capital in such large aggregate sums has necessitated concentration of management and engineering abilities and financial resources. This need has been provided adequately by the holding companies.

*From a recent address before the School of Business, Columbia University.*

## Two New Utility Offerings Made

Financing for a subsidiary company of the Public Service Company of Northern Illinois was announced this week with the offering of an issue of Public Service Subsidiary Corporation 5½ per cent debentures, series A, due January 1, 1949, amounting to $6,000,000. This is the second issue of this nature of a Chicago organization which has been offered, an issue of $20,000,000 Commonwealth Subsidiary Corporation, a subsidiary of Commonwealth Edison Company, having been sold in August of last year. The corporation (all of whose stock, except directors' qualifying shares, is owned by the Public Service Company of Northern Illinois) was formed in December of 1926 to take over, hold and manage securities and other assets then owned by the parent company. These securities and other assets had been acquired by the Public Service Company of Northern Illinois from time to time, but did not strictly constitute a part of its business as a public utility operating company and it was, therefore, considered advisable to transfer such assets to a subsidiary company whose sole purpose would be the retention and management of the assets. The investments of the Public Service Subsidiary Corporation range from substantial holdings in the stock of other utility companies to companies whose consumption of electric energy will stimulate the business of the parent company.

The International Superpower Corporation made an offering of 50,000 shares of capital stock at $51½ per share. This organization was formed last September for the purpose primarily of investing and dealing in securities of public utility operating and holding companies, particularly those interested in generation, transmission or sale of electric energy. The capitalization consists of 500,000 no-par shares.

# Business News and Market Conditions

## Courtright Wins Co-operation Award

### James H. McGraw Medal and Purse for 1928 Awarded to San Francisco Man for Contribution Made to "Through-the-Dealer Plan"

HENRY H. COURTRIGHT, president and manager of the Valley Electrical Supply Company of Fresno, Calif., is the recipient of the James H. McGraw medal and purse for co-operation for 1928. Presentation was made at a luncheon arranged this week by the California Electrical Bureau and officially sponsored by the San Francisco Electrical League, Pacific Coast Electrical Association, Pacific Coast Electrical Jobbers' Association and the Light and Power Association.

The following citation was made in connection with the presentation of the medal:

Henry H. Courtright, president and manager of the Valley Electrical Supply Company of Fresno, Calif., a subsidiary of the San Joaquin Light & Power Corporation, established for the purpose of building residence load, adopted as a fundamental the principle that existing agencies should be utilized in the upbuilding of an effective retail electrical trade. He believed that it would best serve the public and the industry to promote and develop the household appliance business on a basis attractive and profitable to merchants now engaged in it. He was unwilling to attempt to force sales by artificial or arbitrary trade dominance by a public utility, working naturally with the prime motive of increasing the consumption of electricity and only incidental consideration for the economic soundness of its merchandising policies as they affect competing outlets. He approached the problem recognizing that there is a pioneering period in the early life of each important appliance when money and effort must be invested in educational promotion in order to popularize it more quickly. Because the regular merchant looks upon this as a period of experimental development it becomes necessary for the power company to bear the burden of expense to the point where it has won sufficient public acceptance to be salable by ordinary merchandising methods. He accepted also the premise that the life load value of an appliance sold into the home justifies a definite expenditure to secure the business.

Acting on this theory, he entered into a contract with the San Joaquin Light & Power Corporation whereby a definite compensation was to be paid for each kilowatt of load sold onto the system through the efforts of the Valley Electrical Supply Company. He established a "through-the-dealer plan," under which the Valley company entered into a promotional relationship with some ninety-odd retail dealers selling

*H. H. Courtright*

electrical appliances within the territory served by the San Joaquin system. The income derived from the parent company was to be applied to increasing the sales of these dealers through advertising, demonstrating and other measures of promotion and co-operation.

As a result of four years of this activity, the average annual domestic consumption of electricity on the San Joaquin system has been increased from 442 in 1923 to approximately 742 in 1928, and the average sales of appliances per customer has been raised to the high figure of approximately $35 in 1928. The power company is paying no more than the average for other classes of business and is receiving a high rate of return per kilowatt. Dealers have been increasing their sales at the rate of 20 per cent a year. Jobbers and manufacturers are receiving a steadily increasing volume of business. And the entire appliance trade has been brought to a high degree of stability and prosperity, with trade relations immeasurably improved. So conspicuous has been the success of this "through-the-dealer plan" that it has received the official indorsement of the California Association of Electragists. It is being widely discussed throughout the country and watched with increasing interest by electrical men.

Through his personal initiative and leadership in conceiving, organizing and operating this co-operative system of merchandising, Mr. Courtright has made a valuable contribution to the advancement of practical co-operation in the electrical industry, for he is aiding in the solution of one of the industry's most difficult problems. Therefore the judges have awarded to Mr. Courtright the medal and purse for co-operation for 1928 given under the James H. McGraw award.

The committee of judges which awarded the medal to Mr. Courtright consisted of W. W. Freeman, George E. Callinan, James R. Strong and S. L. Nicholson. The committee of awards consisted of W. W. Freeman, H. B. Crouse, W. E. Robertson, L. K. Comstock, F. M. Feiker and Earl Whitehorne.

## Ten per Cent Increase in Construction Contracts

Contracts awarded during 1928 amounted to $3,578,585,000, an increase of 10 per cent over those reported for 1927, according to data collected throughout the year by the *Engineering News-Record*.

The greatest increase in the annual volume of contracts that were awarded was recorded for commercial buildings, the value of these projects during 1928 exceeding the 1927 volume by about $227,000,000. Other increases were reported by the water-works group, increasing by about $46,000,000; industrial buildings about $68,000,000, streets and roads about $90,000,000.

*Value of Contracts by Sections in the United States and Total for Canada, December, 1928*

Thousands of dollars (-000 omitted)

| | New England | Middle Atlantic | South | Middle West | West of Mississippi | Far West | United States Dec., 1928 | United States Year 1928 | Canada |
|---|---|---|---|---|---|---|---|---|---|
| Water-works | $230 | $5,369 | $14 | $794 | $1,305 | $257 | $7,969 | $99,442 | $1,512 |
| Sewers | 250 | 305 | 632 | 2,292 | 1,371 | 1,246 | 6,096 | 100,732 | 3,772 |
| Bridges | 25 | 2,460 | 4,613 | 1,410 | 2,066 | 77 | 10,561 | 130,203 | 7,795 |
| Excavations, drainage, etc | ..... | ..... | ..... | 178 | 4,530 | 58 | 4,766 | 37,734 | 6,432 |
| Streets and roads | 235 | 4,532 | 2,539 | 2,942 | 8,632 | 4,271 | 23,151 | 615,279 | 23,158 |
| Industrial buildings | 2,967 | 6,417 | 1,246 | 10,236 | 2,377 | 1,672 | 24,915 | 355,187 | 27,750 |
| Commercial buildings | 9,020 | 42,815 | 5,082 | 22,750 | 18,143 | 20,462 | 118,272 | 1,859,418 | 66,999 |
| Federal government | 341 | 1,994 | 523 | 256 | 354 | 22 | 3,490 | 69,815 | ..... |
| Unclassified | 205 | 2,748 | 9,402 | 10,352 | 14,772 | 308 | 37,787 | 310,775 | 38,146 |
| December, 1928* | 13,273 | 66,640 | 24,051 | 51,210 | 53,550 | 28,373 | 237,097 | ..... | ..... |
| November, 1928† | 19,947 | 147,593 | 17,984 | 53,751 | 36,245 | 30,509 | 306,029 | ..... | ..... |
| December, 1927† | 21,650 | 134,125 | 30,049 | 66,727 | 99,950 | 25,343 | 377,844 | ..... | ..... |
| Total year 1928 | 222,242 | 1,383,111 | 290,525 | 809,463 | 537,733 | 335,511 | ..... | 3,578,585 | 175,564 |
| Total year 1927 | 234,274 | 988,994 | 290,465 | 775,955 | 593,417 | 370,661 | ..... | 3,253,766 | 180,763 |

*Four weeks. †Five weeks.

# Market Conditions

SIZING up the market possibilities for 1929, electrical equipment producers are highly optimistic. Current buying is above the average for the opening weeks of a new year. The power companies have much replacement and new buying in contemplation and in many sections are buying quite heavily at present. The railroads have huge programs mapped out for the year and industrial demand, according to current surveys of the manufacturing industries, will show steady growth in all but a few branches.

In New England and the Eastern district several substantial central-station orders are recorded. In the latter area this business is larger than for some months. Meter and accessory business has also revived. The Southeast reports satisfactory day to day business with few outstanding orders.

Industrial and railroad demands are giving rise to substantial orders in the Middle West and the St. Louis districts. Current power company needs are also substantial.

Miscellaneous construction and other demands are keeping the volume of business on the Pacific Coast at a level somewhat above the average. Prospects are for an exceedingly active year both in the Northern and Southern areas.

## *Strong Central-Station Demand in Eastern District*

Business is maturing in heavy volume in the Eastern district, with prime movers and affiliated equipment in strong demand. Inquiries are keeping pace with orders and immediate future commitments appear certain. Central-station buying is reaching a higher level than for several months past. A New England central station has placed a contract with a Pennsylvania manufacturer for three 35,000-kw. generator sets and accessory apparatus to cost $1,000,000. A power company in Montana has ordered two 25,000-kw. water-wheel generators from the same maker, costing $400,000. A New York manufacturer reports an order from a plant in New Jersey for a 750-kw. turbo-generator unit, approximating $25,000. Transformer account is again coming into its own after an inactive period and a New Jersey central station has given a commitment for four 30,000-kw. units at a cost of $750,000. A northern New York utility company has placed an order for transformers to cost $30,000.

With a lagging demand for meters and accessories for several months, immediate revival in buying can now be recorded. As a forerunner to what is ahead, a metropolitan central station has placed an order for meters to cost $30,000. According to one manufacturer, the call for motors is a little slow, with the majority of sales for units of low horsepower rating, while another maker says that improvement in motor demand is noted and that an early volume of sales are on the way. Fractional-horsepower units are securing better interest and such motors for refrigeration and oil burner installations are developing sizable account. A maker of motion-picture equipment has placed an order for fractional-horsepower motors to a sum of $30,000.

Marine business continues to expand and prospects are highly encouraging. The Ward Line has placed a contract for electrical equipment for two new turbine-electric liners. The Panama-Pacific Line will equip a passenger vessel to be built by the Newport News Shipbuilding & Dry Dock Company, Newport News, Va., with electric drive. Railway business is another promising factor in the heavy equipment market and good business is expected from this quarter in the near future. A manufacturer of isolated electric-lighting plants for farm and rural service reports good sales and increasing inquiries. Construction projects are as follows:

The Eastman Kodak Company, Rochester, N. Y., will build an addition to cost $200,000. The American Cyanamid Company, New York, has purchased lands at Plant City, Fla., and contemplates a mining and refining plant to cost $350,000. The Ludlum Steel Company, Watervliet, N. Y., plans an addition to cost $100,000. The Singer Ice Company, Newark, N. J., will build an addition to cost $65,000. The Rundle Manufacturing Company, Milwaukee, Wis., will build a plumbing equipment manufacturing plant at Camden, N. J., to cost $1,000,000. The Consolidated Instrument Company of America, Ltd., New York, will build an addition to the plant of its affiliated organization, Julian L. Friez & Sons, Baltimore, Md., to cost $100,000. The Lehigh & Wilkes-Barre Coal Company, Wilkes-Barre, Pa., has approved electrification of its plant at Green Mountain, Pa. The American Car & Foundry Company, Berwick, Pa., will build an addition to cost $90,000. I. Fischman & Sons, Philadelphia, will build a factory for the manufacture of soda fountains, etc., to cost $350,000. The Aluminum Company of America, Pittsburgh, will build a mill at Alcoa, near Knoxville, Tenn., to cost $2,000,000. The Pittsburgh Plate Glass Company, Pittsburgh, plans a branch plant at El Segundo, near Los Angeles, Calif., to cost $1,000,000. The South Beaver Clay Products Company, Beaver Falls, Pa., plans a sewer pipe manufacturing plant at Negley, Pa., to cost $100,000. Harrisburg, Pa., plans an ornamental lighting system. Glenn L. Martin Company, Cleveland, plans an aircraft plant at Baltimore, Md., to cost $1,200,000. The Department of Commerce, Washington, will receive bids until Jan. 28 for electric airway beacons for the Evansville-Lafayette section of the Atlanta-Chicago airway (Proposal 20,390). The General Purchasing Officer, Panama Canal, Washington, is asking bids until Feb. 1 for cable, wire, switches, electric insulation, batteries, telephone cords, etc. (Panama Schedule 1933.)

## *New England Buying Well Sustained*

Well-sustained buying, considering this time of the year, is reported in the New England district. Inquiries and negotiations are demanding considerable attention, with power development equipment foremost in interest. Large contracts for northern New England power equipment amounting to over $1,000,000 will soon be awarded and bids are in for several northern New England large line equipment projects. Small motor sales are numerous in small lots and went up over $40,000 for one manufacturer, and another reports the sale of a number of large motors ranging up to 200 hp. An order for synchronous motors with control amounting to over $4,500 also was reported. Industrial electric heating furnaces are attracting attention and much interest is reported among machine tool manufacturers. In the opinion of one manufacturer this business has practically doubled in this district as compared with last year. A survey of merchandising activities in this district shows that appliance sales during the past year gained appreciably, with ranges, refrigerators and heaters making marked gains. Construction projects are as follows:

The Litchfield Electric Light & Power Company, Litchfield, Conn., will build a transmission line to Harwinton, Conn., and install a local commercial system to cost $35,000.

## *Business Satisfactory with Good Inquiries in Southeast*

A reasonably satisfactory volume of business, with few orders of any particular size but a large number of inquiries, is reported for the Southeast. A power company in the western portion of the territory ordered power transformers and switching equipment approximating $90,000. Another power company's switching equipment orders totaled $11,100 for air brake switches and $8,600 for disconnect switches. A Georgia company ordered metering equipment aggregating $5,400, while an Alabama central station placed an order for 300 watt-hour meters. Some other power company orders were for $5,800 in poles and pole line materials and $5,760 in distribution and street lighting transformers. Some orders in immediate prospect are for "white-way" equipment on a replacement job in a north Georgia town, which equipment will approximate $5,000, and $5,000 in disconnect switches for three substation jobs in Georgia. Electrical equipment

amounting to approximately $100,000 for a substation job in North Carolina also is in prospect. A new paper mill in Alabama has ordered switching equipment amounting to $35,000, while another similar mill in the same state ordered motor equipment to the extent of $4,000. A cotton mill in Georgia ordered safety switches aggregating $5,000 and panelboards costing $6,000 were ordered for an office building being constructed in Atlanta. Construction projects are as follows:

The Virginia Public Service Company, Charlottesville, Va., will build a transmission line at Frankford, Rainelle, W. Va., and vicinity. Danville, Va., plans a flood lighting system and beacon lamps at the proposed municipal airport. The Oliver King Sand & Lime Company, Knoxville, Tenn., plans extensions to cost $85,000. The Carolina Power & Light Company, Raleigh, N. C., has contracted to supply power at the rayon mill of the American Enka Corporation near Asheville, N. C., and will extend lines and install a substation. The Mississippi Utility Company, Jackson, Miss., plans a hydro-electric power plant on the Chunky River, to cost $200,000. The Goodyear Tire & Rubber Company, Akron, Ohio, has asked bids on a general contract for initial unit of a mill at Gadsden, Ala., to cost $2,000,000. The Louisville & Nashville Railway Company, Louisville, Ky., plans a car and locomotive shop at Mobile, Ala., to cost $325,000. The Stringer Brothers Company, Gadsden, Ala., plans an addition to its plumbing specialty manufacturing plant to cost $100,000. The Alabama Power Company, Birmingham, Ala., plans a hydro-electric power plant on the Tallassee River, with capacity of 84,000 kw. to cost $15,000,000. The Southern Sugar Company, Clewiston, Fla., plans a mill at Canal Point, Fla., to cost $3,000,000.

## *Good Business Expected in St. Louis District*

The volume of orders and inquiries coming from power companies indicate clearly that there will be exceptionally good spring business in the St. Louis district. Orders of contract size that were placed include a 7,500-kva. transformer for a local power company costing $12,000, a lot of motors for drilling and pumping by a Western oil company costing $10,000 and two 75-kw. generators with a switchboard costing $4,000 for an ice company. Building operations are opening up in good shape and several contracts have been placed for wiring and fixtures, including the $45,000 contract for the electrical equipment of a new express building. Orders for stock sizes of motors and transformers are coming in steadily and in good volume. Construction projects are as follows:

The Parks Aircraft, Inc., St. Louis, will build an aircraft manufacturing plant near the Parks airport, to cost $200,000. The Oklahoma Gas & Electric Company, Oklahoma City, Okla., plans a group of fifteen substations to cost $350,000. Anadarko, Okla., contemplates a municipal electric light and power plant and waterworks to cost $110,000. The Pine Bluff Heading Company, Pine Bluff, Ark., plans an addition to its cooperage plant, to cost $60,000. The West Texas Utilities Company, Abilene, Tex., will build additions to its transmission lines totaling 25 miles, to cost $90,000. The Orange Crush Corporation, Chicago, contemplates a beverage plant at Port Arthur, Tex., to cost $300,000. The Abdow Poultry & Produce Company, El Paso, Tex., plans a cold storage and refrigerating plant and packing plant to cost $225,000.

## *Many Orders Placed on Pacific Coast*

Manufacturers on the Pacific Coast report many fair-sized orders, such as electric welding sets and motors for steel plants and oil refineries and ore-treating machinery for Mexican mines. Awards for the week include one for $21,384 for a Sacramento street lighting, $61,700 for an electric crane for the Mare Island navy yard and $14,450 for an electric crane for the San Diego naval air base. Orders included two carloads of poles for a Bakersfield oil company, wire and pole line material for the city of Gridley, street lighting cable for the city of Sacramento, one carload of poles each for Fresno, Napa and St. Helena and $13,000 worth of tops and transformers were sold to a power company. Prospective business includes a 26-acre, $1,000,000 farm products terminal for Sacramento, a $3,000,000 bridge to connect San Diego and Coronado, a $750,000 hospital for Pasadena and $1,000,000 for new buildings for the veterans' home at Sawtelle. Street lighting installations are being planned for Salinas and Oakdale. The California state budget for 1929-30 includes nearly $3,500,000 for extensions and alterations to hospitals. The new year has been featured by greatly increased activity among electrical contracts. Building construction, however, dropped considerably during 1928, the totals being $101,678,768 for Los Angeles, $37,766,731 for San Francisco and $19,596,240 for Oakland, as compared with 1927 totals of $123,027,139, $47,032,848 and $20,794,669 respectively.

The awards of contracts for furnishing equipment for the $5,000,000 Shuffleton steam plant at Renton, near Seattle, which is being built by Stone & Webster for the Puget Sound Power & Light Company, announced last week, include a 35,000-kw. main turbine, a 2,500-kw. auxiliary turbine, a 40,000-sq.ft. condenser, a boiler and a superheater, water walls for boilers, boiler feed pumps and evaporators. Orders reported for motors were small and scattered. Specifications are out for motors and equipment for a planing mill at Anacortes, Wash., for the E. K. Wood Lumber Company and for a lumber mill of the McCormick Lumber Company at Port Gamble, Wash., the latter involving between $60,000 and $70,000 in motors, apparatus and mill machinery. Early this spring the town of Centralia, Wash., will vote on a $1,000,000 bond issue to cover the cost of constructing a municipal hydro-electric plant, for which preliminary details have been completed. The construction of a 33-block area distribution system to serve the business district is proposed in Aberdeen, Wash. The Pacific States Pulp & Paper Company, of Aberdeen, is planning a $1,000,000 pulp mill at Priest River, Idaho. Construction projects are as follows:

The Real Estate Investment Company, Glendale, Calif., will install a floodlighting system and beacon lamps at its airport to cost $200,000. The Columbia Steel Company, Pittsburg, Calif., will build a tin plate mill to cost $2,000,000. The Salvador Castorina Company, Cucamonga, Calif., will build additions to its extraction and distilling plant to cost $200,000. Pittsburg, Calif., plans extensions in fire and police signal alarm systems. Fairfield, Calif., plans a municipal electric light and power plant. The Los Angeles Gas & Electric Company, Los Angeles, plans improvements in its electric plant and system, including substations, and underground lines, to cost $1,000,000. The Pacific Coast Steel Company, South San Francisco, Calif., will build an addition to cost $450,000. The Santa Maria Refrigerating Company, Santa Maria, Calif., will build an addition to its ice and refrigerating plant to cost $35,000. Fresno and San Jose, Calif., plan ornamental lighting systems with underground conduit systems. The Southern Oregon Sales Company, Medford, Ore., plans an addition to the cold storage and refrigerating plant, and fruit packing house, to cost $100,000. The Associated Furniture Manufacturers, Portland, Ore., plan a plywood plant near Aberdeen, Wash., to cost $200,000. The Pacific Straw Paper & Board Company, Longview, Wash., contemplates a plant unit to cost $100,000. The Great Northern Railroad Company, St. Paul, Minn., plans additions to its shops at White Fish, Mont., to cost $80,000. The Great Western Sugar Company, Denver, Colo., plans a beet sugar mill at Wheatland, Wyo., to cost $750,000. Phoenix, Ariz., and Pueblo, Colo., plan ornamental lighting systems. Charles Viestenz, Loveland, Colo., and associates will build a light and power plant at Delta, Colo., to cost $50,000.

## *Most Sections of Middle West Report Good Business*

While an apparent lag is noticeable in some lines, the general volume of business transacted is appreciably large and well diversified in the Middle West district. Yearly reports now being published indicate a satisfactory year in practically all industries with a remarkable advancement in a few. An enormous amount of capital is scheduled for expenditure by the various railroad companies, one Western road alone appropriating $25,000,000 for new equipment in addition to $21,000,000 for completion of work now in progress. The automotive industry continues to prosper with an increase in employment. The steel industry is in excellent shape and the various utility companies are preparing to supply the anticipated increase in demand for service. Considerable purchasing of equipment is going on and among the interesting orders placed were the following: Switching equipment and transformers valued at $310,000, 250 10-kva. pole type distribution transformers, 670 Thompson meters of 5 to 1,200 amp. capacity and 50 current transformers. There has been an excellent demand for poles, pole line

hardware and insulators. Jobbers' sales are normal. Construction projects are as follows:

The All-Metal Products Company, Wyandotte, Mich., contemplates a plant addition to cost $100,000. Berry Brothers, Inc., Detroit, will build an addition to its plant factory to cost $100,000. The Bentson Manufacturing Company, Aurora, Ill., plans an addition to its filing equipment manufacturing plant, to cost $175,000. The Borden Farm Products Company, Chicago, plans a bottling plant at Forest Park, Ill., to cost $200,000. Kenosha, Wis., River Forest and La Grange, Ill., plan ornamental lighting systems. The Oil-O-Matic Heating Corporation, Bloomington, Ill., plans an addition to its fuel oil burner plant, to cost $125,000. The American Pneumatic Carpet Cleaning Company, Chicago, plans a plant to cost $85,000. The Teletype Corporation, Chicago, will build a plant addition for the manufacture of automatic telegraph apparatus to cost $230,000. Indianapolis, Ind., plans a power plant at the City Hospital to cost $450,000. The Gramm Motors Company, Delphos, Ohio, plans an addition to its motor truck plant, to cost $90,000. The Crosley Radio Corporation, Cincinnati, Ohio, plans a factory to cost $500,000. The Nebraska Power Company, Omaha, Neb., plans expansion.

### *Metal Markets Quietest in Months*

The holiday lull in the metal markets arrived three weeks late. Scarcely any business at all has been done in copper and zinc, and lead and tin have also been in much less demand than normally. Prices, however, have been generally firm, for the volume of business has been so good in the last month or two that producers are inclined to welcome a breathing spell. There is every indication, also, that consumption is as good as ever.

NEW YORK METAL MARKET PRICES

| | Jan. 9, 1929 Cents per Pound | Jan. 16, 1929 Cents per Pound |
|---|---|---|
| Copper, electrolytic | 16.75 | 16.75 |
| Lead, Am. S. & R. price | 6.65 | 6.65 |
| Antimony | 9.625 | 9.50 |
| Nickel, ingot | 35 | 35 |
| Zinc, spot | 6.70 | 6.70 |
| Tin, Straits | 49.875 | 49.125 |
| Aluminum, 99 per cent. | 24.30 | 24.30 |

Base copper wire price Jan. 16, 1929, 18¼ cents.

# Activities of the Trade

## General Electric Orders for 1928 Increase 13 per Cent

Orders received by the General Electric Company during the year 1928 amounted to $348,848,512, compared with $309,784,623 for 1927, an increase of 13 per cent, Gerard Swope, president, has announced. The orders for the December quarter totaled $88,162,049, as compared with $76,708,532 for the corresponding period in 1927, an increase of 15 per cent.

## Standard Underground Announces Staff Changes

The Standard Underground Cable Company, Pittsburgh, Division of General Cable Corporation, announces several changes in its sales personnel and in branch office locations. C. J. Marsh has been transferred to the staff of the General Cable Corporation to supervise the purchase of metals, R. S. Hopkins has been appointed manager of the New York office and O. G. Miller has been appointed assistant manager. The Atlanta, Ga., office, formerly a sub-office of Washington, D. C., has been made a main branch sales office and E. B. Hook, Jr., has been appointed manager and J. A. Peacock district manager. The address of the Atlanta office has been changed from the Candler Building to the Healey Building. New district sales offices have been opened in Birmingham, Ala., and Charlotte, N. C., with M. L. Tice and W. D. Hampton as district managers, respectively. The Birmingham office is located in the Watts Building and the Charlotte office is in the First National Bank Building. The Chicago office has been removed from the Conway Building to the Bankers Building and the St. Louis office has been changed from the Arcade Building to the Ambassador Building. E. Kerschner was transferred to the Chicago office as manager of that territory and H. C. Richardson has been appointed manager of the Washington office. E. J. Pietzcker, formerly manager of both the Chicago and St. Louis offices, is now in the St. Louis office. Arthur Z. Barnes has been appointed district manager at Dallas, Tex., with offices in the Allen Building. This is a sub-office of St. Louis. George C. Knowles, Jr., has been appointed salesman in the Pittsburgh sales office.

## Gamewell Company Expands Its Operations

By the acquisition of the Holtzer-Cabot Electric Company and the Harrington Seaberg Corporation the Gamewell Company of Boston, Mass., electric signal system manufacturer, will increase its volume close to 100 per cent. The combination will have 118,928 shares of stock outstanding, representing all capital obligations. This compares with the former 67,500 shares of common stock and 1,000 management shares outstanding. Management shares were exchanged for 14,000 common and holders of 81,500 shares of total common were privileged to subscribe to new stock at $70 in the ratio of one to three held. An absorption of 27,167 shares was thus effected.

Gamewell and Harrington Seaberg employees purchased in excess of 10,000 shares. Net earnings of the three combined companies for the six months ended Dec. 31 were totally estimated at $478,197, equivalent to $4.02 a share under the new capital structure. Earnings are fixed at this rate to $8 a share annually on the stock, which is receiving $5 a share annual dividends. The consolidated balance sheet shows current assets about $3,600,000 and liabilities amounting to $240,000, which provides for a working capital of $3,360,000.

## Wadsworth Company Holds Annual Sales Conference

The Wadsworth Electric Manufacturing Company, Covington, Ky., held its first annual sales conference on December 27, 28 and 29. Every Wadsworth sales engineer from every part of the country was present. Some time was spent in reviewing the past years and the sales record of business for safety electric switches and much time was given to the planning of a definite sales program for the coming year.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has taken over the assets of the R. D. Nuttall Company as of January 1 and will carry on the operations of the Nuttall company as a branch of the Westinghouse Electric & Manufacturing Company. The Nuttall plant will be known as the Nuttall Works and the product will be called Westinghouse-Nuttall.

THE GENERAL REFRACTORIES COMPANY, 104 South Sixteenth Street, Philadelphia, has changed the address of its Detroit office to 6-230 General Motors Building. The office will continue to be in charge of J. L. Graham.

THE WAGNER ELECTRIC CORPORATION, St. Louis, announces a new rubber-mounted motor, the 57RA, a new development in refrigeration motors, designed and developed especially for the electric refrigeration industry.

THE TRUMBULL ELECTBIC MANUFACTURING COMPANY, Plainville, Conn., manufacturer of electrical supplies, has employed the following additional salesmen: C. R. Wood to travel the St. Louis district; F. M. Oglee has been appointed in Chicago as assistant to S. B. Hallberg; S. B. Storer in Cincinnati takes the place of E. F. Storm, who has been transferred to the Philadelphia office, and W. C. Anderson will be located in Pittsburgh, effective about February 1, taking the place of F. M. Buckley, who will be transferred to New York City.

THE GENERAL ELECTRIC SUPPLY CORPORATION, New York City, has acquired the Captial Electric Company, Salt Lake City, Utah, as of January 1, 1929, and the Butte Electric Supply Company, Butte, Mont., as of November 1, 1928.

The new company will have its headquarters in Salt Lake City and will maintain branches at Denver and Butte. Jacob A. Kahn of the Capital Electric Company will continue as president and general manager of the new organization, John J. Cooper will be manager of the Denver branch and Ward E. Graham will be manager of the Butte branch. The organization will operate throughout Utah, Idaho, Nevada, New Mexico, Colorado, Wyoming, Montana and South Dakota.

THE NORTHERN EQUIPMENT COMPANY, Erie, Pa., has appointed Bradshaw & Company, 530 Fourth Avenue, Pittsburgh, to represent the "Copes" system of boiler feed control in the Pittsburgh district. Grant D. Bradshaw is president of this newly organized firm, which is to specialize in power plant and steel mill equipment. Mr. Bradshaw was formerly president of the Andrews-Bradshaw Company until its consolidation with the Blaw-Knox Company on January 1, 1928. During 1928 he was manager of the Andrews-Bradshaw division of the Blaw-Knox Company, resigning the first of this year to organize Bradshaw & Company.

THE GENERAL ELECTRIC COMPANY has appointed William J. Hanley and Charles K. West as commercial vice-presidents. Mr. Hanley is manager of the East Central district, with headquarters in Cleveland, and Mr. West is manager of the Atlantic district, with headquarters in Philadelphia.

THE BLACK & DECKER MANUFACTURING COMPANY, Towson, Md., manufacturer of portable electric tools, announces a reduction in price on its ¼-in. light duty drill from $28 to $25.

THE FOUR-WHEEL DRIVE AUTO COMPANY, Clintonville, Wis., manufacturer of trucks, announces that G. D. Simonds, formerly with the Graybar Electric Company as tool sales engineer, is now sales engineer for its company. Mr. Simonds will be located in New York City and will devote his time to the development and sale of public utility trucks, winches, derricks, trailers, etc.

THE ELECTRIC MACHINERY MANUFACTURING COMPANY, Minneapolis, manufacturer of synchronous motors and vertical alternators, has received orders from the New Cornelia Copper Company, Ajo, Ariz., for 24 motors.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY announces that R. H. Stevens has been transferred to its Philadelphia district office, where he will devote his efforts to the promotion and sale of prime mover apparatus. Mr. Stevens was formerly located at the South Philadelphia works of the company as assistant to C. G. Ong, manager of small turbine sales.

THE INTERNATIONAL COMBUSTION ENGINEERING CORPORATION, 200 Madison avenue, New York City, announces that its subsidiary the F. J. Lewis Manufacturing Company, producer of coal tar products, will hereafter be known as the International Combustion Tar & Chemical Corporation, with offices at 200 Madison avenue, New York City, and 2500 South Robey Street, Chicago.

THE BLACK & DECKER MANUFACTURING COMPANY, Towson, Md., manufacturer of portable electric tools, has merged with the Domestic Electric Company, 7223 St. Clair Street, Cleveland, Ohio, manufacturer of fractional-horsepower electric motors.

THE UNION METAL MANUFACTURING COMPANY, Canton, Ohio, has entered into an agreement with the King Company of Sheffield, Ala., manufacturer of cast-iron street lighting products, to sell all of its products. The General Electric Merchandise Distributors' Association and the Graybar Electric Company, Inc., will act as agencies for the Union Metal Manufacturing Company in selling steel and iron lighting standards.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., reports that one of the largest synchronous motors ever built was recently shipped from the East Pittsburgh works to the Columbia Steel Corporation in Pittsburg, Calif. The motor has a diameter of 25 ft. with a total weight of 176,000 lb. The company recently made the first shipment on an order for ten large synchronous motors for the Du-Pont Engineering Company.

THE LINCOLN ELECTRIC COMPANY, Cleveland, manufacturer of "Linc-Weld" motors and "Stable-Arc" welders, announces the appointment of J. E. Durstine as district sales representative for the Southeast with headquarters at Birmingham, Ala., and H. P. Egan has been appointed for central Ohio with headquarters at Columbus, Ohio.

# New Equipment Available

## Undervoltage Device with Time-Delay Element

Two new pieces of equipment designed for protection against failure of voltage in power circuits after a suitable interval has elapsed have been introduced by the General Electric Company under the designations MG-2 and PF-2. They are adapted to trip the breaker in the circuit only after a suitable time interval and will not cause interruption to service when momentary voltage dips occur. One of these devices, designated MG-2, is equipped to operate in conjunction with suitable motor-operated mechanisms and is available for use on alternating-current circuits only. It has an electrically interlocked switch which is so connected that power cannot be turned on unless the protective unit is in operative condition. It is especially adopted for motor and synchronous converter service where it is desired to have the oil circuit breaker open when voltage fails or drops below a certain per cent of normal voltage for an appreciable time.

Each device contains a motor, a helical spring and a gear train. In operation the motor runs and keeps the spring compressed through the gear train. Upon drop of voltage the spring reverses the motor and runs the gear train in the opposite direction. If the undervoltage persists the travel along the gear train is completed and the circuit is broken by means of a tripping device. The PF-2 undervoltage device is of the solenoid and plunger type, with an air bellows for time delay.

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CURTIS LIGHTING, INC., Chicago, manufacturer of X-ray reflectors, has introduced three new fittings to be used with "Curtistrip," the standardized wiring device, also manufactured by it. These devices have been designed to add greater facility to the many adaptations of "Curtistrip" in all kinds of wiring installations. One is a service box developed to meet the demands for fitting which would allow larger than ½-in. conduit to be connected with "Curtistrips." It is provided with ¾-in. knockouts on each side and on the top and bottom. The second, which is a receptacle, is made with a shade-holder groove which makes it adaptable to the X-ray form X holder and all standard shade holders for porcelain receptacles. The third attachment allows for connecting ½-in. BX to "Curtistrip" at any point.

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## Compensator with High Interrupting Capacity

A new manual starting compensator with high interrupting capacity has just been announced by the General Electric Company. It is particularly applicable to the control of high-speed squirrel-cage motors, including all two- and most four-pole motors, particularly those driving loads on relatively high inertia and therefore taking high in-rush currents and requiring considerable time to get up to speed.

Among the advantageous features claimed for the new compensator by the manufacturer are (1) a switch design providing wide break and high interrupting capacity; (2) time-delay, undervoltage release, preventing shut-down on brief power disturbances and assuring that in case of short circuit the line protective devices will open first; (3), contact tips of standard contactor construction and action, reducing maintainance cost to a minimum; (4), cabinet construction of case for wall mounting with ample room for ready connections and access to all parts.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued Dec. 25, 1928)

17,171 (reissue). COMBINED TRANSFORMER AND CONDUIT-BOX COVER; A. E. Rittenhouse, Honeoye Falls, N. Y. App. filed May 1, 1926.

1,696,226. PROTECTIVE SYSTEM FOR ELECTRIC CABLES; D. Douchet, Paris, France. App. filed April 12, 1927.

1,696,230. ELECTRICAL PILOTAGE; J. J. Gilbert, Port Washington, N. Y. App. filed June 30, 1923.

1,696,248. CIRCUITS FOR SYNCHRONOUS MOTORS; E. R. Morton, Brooklyn, N. Y. App. filed April 6, 1927.

1,696,265. ACOUSTIC DEVICE; O. E. Buckley, Maplewood, N. J. App. filed Nov. 29, 1926.

1,696,266. ELECTRICAL TESTING DEVICE; J. M. Coote, Elizabeth, N. J. App. filed July 25, 1922.

1,696,276. MULTIBREAK ELECTRIC SWITCH; A. C. Kelle, Canton, Mass. App. filed April 1, 1925.

1,696,289. PROTECTIVE APPARATUS AND SYSTEM; J. D. Wood, Wollaston, Mass. App. filed July 24, 1925.

1,696,296. MULTIBREAK ELECTRIC SWITCH; W. S. Edsall, Boston, Mass. App. filed April 1, 1925.

1,696,301. CONTACT STRUCTURE FOR ELECTRIC SWITCHES; T. T. Greenwood, East Templeton, Mass. App. filed May 29, 1925.

1,696,316. RAIL BOND; C. G. McCaulley, Jacksonville, Fla. App. filed Dec. 12, 1923.

1,696,334. METHOD OF TESTING STORAGE BATTERIES; H. I. Shire, Detroit, Mich. App. filed Sept. 16, 1920.

1,696,340. DISTRIBUTOR; E. A. Bohlman, Chicago, Ill. App. filed July 11, 1924.

1,696,348. ELECTRICAL APPARATUS; W. R. Frampton, Los Angeles, Calif. App. filed Aug. 1, 1922.

1,696,416; 1,696,417. VOLTAGE REGULATOR; L. C. Roberts, Towaco, N. J. Apps. filed Aug. 9 and Sept. 3, 1927.

1,696,455. CIRCULAR-SEAM-WELDING APPARATUS; W. E. Rupley, Los Angeles, Calif. App. filed April 13, 1925.

1,696,491. INSULATOR RACK; W. D. Kyle, Milwaukee, Wis. App. filed Sept. 24, 1923.

1,696,495. ELECTRIC APPLIANCE; M. J. Malling, Grand Rapids, Mich. App. filed July 11, 1927.

1,696,531. TERMINAL CONNECTION; J. H. Eaton, Colby, Kan. App. filed Sept. 24, 1927.

1,696,544. SIGNALING SYSTEM OR THE LIKE; N. H. Holland, East Orange, N. J. App. filed July 13, 1920.

1,696,548. ELECTRICALLY-DISPLAYED WRITING APPARATUS; C. Lauria, New York, N. Y. App. filed Sept. 21, 1926.

1,696,568. BATTERY TERMINAL; F. F. Fogel, Hawarden, Iowa. App. filed July 6, 1926.

1,696,570. OIL SWITCH; J. D. Hilliard, Schenectady, N. Y. App. filed March 30, 1922.

1,696,571, 1,696,572, 1,696,573. ELECTRIC SWITCH; J. D. Hilliard, Schenectady, N. Y. Apps. filed Jan. 6, 1923, Jan. 2, 1924, and May 27, 1924.

1,696,582. ELECTRIC-SWITCH-OPERATING MECHANISM; W. K. Rankin, Schenectady, N. Y. App. filed Aug. 1, 1923.

1,696,583. COUPLING FOR ELECTRIC CIRCUITS; H. R. Sargent and F. C. DeReamer, Bridgeport, Conn. App. filed May 10, 1927.

1,696,591. SYSTEM OF DISTRIBUTION; L. F. Blume, Pittsfield, Mass. App. filed June 29, 1927.

1,696,594. ELECTRIC INCANDESCENT LAMP; P. O. Cartun, Cleveland Heights, Ohio. App. filed June 9, 1925.

1,696,596. RESISTANCE UNIT; C. Dantsizen, Schenectady, N. Y. App. filed April 5, 1926.

1,696,598. PROTECTIVE SYSTEM; A. S. FitzGerald, London, England. App. filed April 19, 1922.

1,696,599. REGENERATIVE BRAKING; P. W. Forsberg, Schenectady, N. Y. App. filed Nov. 3, 1925.

1,696,600. DEMAND-METER ATTACHMENT FOR FLUID METERS; C. I. Hall, Fort Wayne, Ind. App. filed Feb. 11, 1925.

1,696,601. SYSTEM OF MOTOR CONTROL; C. I. Hall, Fort Wayne, Ind. App. filed Sept. 13, 1926.

1,696,604. FLUID-BREAK SWITCH; J. D. Hilliard, Schenectady, N. Y. App. filed March 30, 1922.

1,696,605. COMBINED RESISTOR AND FUSE; H. P. Hollnagel, Swampscott, Mass. App. filed Jan. 6, 1926.

1,696,611. PROTECTIVE DEVICE; G. R. McDonald, Schenectady, N. Y. App. filed May 28, 1925.

1,696,612. COOLING SYSTEM FOR DYNAMO-ELECTRIC MACHINES; C. W. Rice, Schenectady, N. Y. App. filed Oct. 17, 1925.

1,696,615. ELECTROMAGNET; P. Trombetta, Schenectady, N. Y. App. filed May 9, 1927.

1,696,616. BINDING POST; F. C. Wappler, New York, N. Y. App. filed March 16, 1927.

1,696,617. ELECTRORESPONSIVE CONTROLLING DEVICE; A. F. Welch, Fort Wayne, Ind. App. filed March 29, 1927.

1,696,621. CENTRIFUGAL SWITCH; H. L. Brump, Dayton, Ohio. App. filed Aug. 7, 1924.

1,696,627. PIEZO-ELECTRIC CRYSTAL; A. Crossley, Washington, D. C. App. filed Oct. 12, 1925.

1,696,663. CONNECTER FOR INCANDESCENT LAMPS; G. F. Becker, Bremen, Germany. App. filed Dec. 29, 1927.

1,696,684. HEATER CONTROLLER; O. A. Knopp, Oakland, Calif. App. filed April 13, 1927.

1,696,712. DOOR-OPERATED SWITCH; H. Glaser, New York, N. Y. App. filed Dec. 23, 1927.

1,696,713. CIRCUIT CLOSER; J. T. Harrigan, Plainfield, N. J. App. filed July 12, 1923.

1,696,744. ELECTRIC CONTROLLING DEVICE; C. W. Wyman, Claremont, N. H. App. filed July 22, 1918.

1,696,745. FUSE MECHANISM; C. W. Wyman, Claremont, N. H. App. filed Aug. 10, 1923.

1,696,746. CONTROLLING MECHANISM; C. W. Wyman, Claremont, N. H. App. filed March 24, 1924.

1,696,747. INTERLOCKING MECHANISM; C. W. Wyman, Claremont, N. H. App. filed Dec. 5, 1925.

1,696,748. CONTROLLING APPARATUS; C. W. Wyman, Claremont, N. H. App. filed Nov. 26, 1926.

1,696,750. STATIC-DISCHARGE DEVICE FOR ROTARY STENCIL DUPLICATING MACHINES; E. J. Brasseur, Chicago, Ill. App. filed May 8, 1925.

1,696,758. WATER HEATER; A. Galdi, Somerville, and E. S. Peterson, Lexington, Mass. App. filed Aug. 2, 1926.

1,696,777. HOLDER FOR ARC-LAMP CARBONS; F. Meyer, Jena, Germany. App. filed Feb. 8, 1928.

1,696,828. WATER HEATER; V. Price-Williams, Miami, Fla. App. filed June 10, 1926.

1,696,842. SIGNALING SYSTEM FOR ELEVATORS; R. H. Gaylord, Los Angeles, Calif. App. filed Aug. 22, 1923.

1,696,861. INSULATOR-SUPPORTING PIN; B. A. Plimpton, Baltimore, Md. App. filed March 21, 1927.

1,696,862. ELECTRICAL APPARATUS; D. C. Prince, Schenectady, N. Y. App. filed Aug. 23, 1926.

1,696,873. MAGNESIUM PRIMARY CELL; R. T. Wood, Niagara Falls, N. Y. App. filed Aug. 5, 1925.

1,696,880. POWER SUPPLY; H. P. Donle, Meriden, Conn. App. filed Feb. 19, 1927.

1,696,895. HIGH-TENSION ELECTRICAL CONDENSER; G. W. Pickard, Newton Center, Mass. App. filed June 26, 1924.

(Issued Jan. 1, 1929)

17,180 (reissue). METHOD AND MEANS FOR STARTING SYNCHRONOUS MOTORS; C. T. Hibbard, Minneapolis, Minn. App. filed Jan. 17, 1920.

1,696,914. CONTROL APPARATUS; W. G. Horn, Edgewood Acres, Pa. App. filed Aug. 7, 1926.

1,696,919. ELECTRICALLY-HEATED CURLING IRON; E. T. Meek, Chicago, Ill. App. filed May 31, 1927.

1,696,931. SERIES CUT-OUT; P. F. Williams, Chicago, Ill. App. filed May 16, 1925.

1,696,953. ELECTRIC SHAVING CUP; G. Harvis, Detroit, Mich. App. filed March 23, 1928.

1,696,964. TRANSFORMER DEVICE; M. Morrison, Chicago, Ill. App. filed Aug. 17, 1925.

1,696,008. ELECTRIC SWITCH; W. R. Huttinger, Lansdowne, Pa. App. filed Dec. 29, 1923.

1,696,021. ALTERNATING-CURRENT ARC LAMP WITH INCLOSED ARC; P. Queisser, Berlin-Friedenau, Germany. App. filed Jan. 27, 1927.

1,697,024. ELECTRIC TOASTER; A. J. Rubin, New York, N. Y. App. filed July 31, 1928.

1,697,033. ELECTRIC-CORD TAKE-UP; A. L. Umscheid, St. George, Kan. App. filed Dec. 4, 1926.

1,697,062. WIRE-SUPPORTING ARRANGEMENT; F. M. Hoffman, Detroit, Mich. App. filed Dec. 27, 1927.

1,697,076. UNSTEPPED FREQUENCY AUDIOMETER; H. R. McDermott, Waterloo, Iowa. App. filed April 27, 1926.

1,697,078. STORAGE-BATTERY PLATE; R. T. Murray and F. M. Kelly, Indianapolis, Ind. App. filed Dec. 5, 1927.

1,697,115. SELF-FEEDING ELECTRICALLY-HEATED WATER BOILER; H. Hargreaves, Burnley, England. App. filed Oct. 21, 1926.

# New Trade Literature

INSULATING MATERIALS.—The Mica Insulator Company, 200 Varick Street, New York City, is distributing a price list effective January 1, 1929, covering its "Mico" and other electrical insulating materials.

ARC-WELDING EQUIPMENT, AIR COMPRESSORS, ETC. — Bulletins GEA-823B and GEA-941A issued by the General Electric Company, Schenectady, N. Y., describe and illustrate its atomic hydrogen arc-welding equipment for hand welding on 50 and 60-cycle circuits only and its type CP motor-driven, center-gear reciprocating air compressors for railway and industrial service. The company also is distributing bulletin GEA-1022A covering its automatic arc welder for steel railroad ties and bulletin GEA-1084 covering its plate type field rheostats for motors and generators.

VISE.—J. H. Williams & Company, Buffalo, N. Y., is distributing a pamphlet describing the "Williams" superior drop-forged chain pipe vise with overhead adjustment and reversible jaws.

WATER TUBE BOILERS.—The Springfield Boiler Company, Springfield, Ill., has issued catalog No. 28, which describes and illustrates its all-steel sectional water tube boilers. The catalog contains illustrations of some very modern boiler installations and sectional views of the boilers installed in various plants also are given.

OIL CIRCUIT BREAKERS.—Leaflet No. 20,399, which supersedes leaflet No. 3400 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes and illustrates its type F-10 alternating-current, oil circuit breakers for indoor service.

INSULATION-TESTING INSTRUMENTS.—Catalog No. 1205 issued by James G. Biddle, 1211 Arch Street, Philadelphia, describes and illustrates the "Megger" insulation-testing instruments used for testing electrical insulation and for measuring electrical resistance. It also contains facsimile scales of the "Megger" and "Bridge-Megger" testing sets.

ELECTRICAL PROTECTIVE DEVICES. —"Our 28th Year" is the title of a catalog issued by the Condit Electrical Manufacturing Corporation, Boston, which describes and illustrates the major new developments of the corporation for the past twelve months. It also features advances in various types of electic protective devices for both indoor and outdoor service, including lower voltage and higher tension circuit breakers, outdoor unit substations, metal-clad switchgear and switch houses.

CONDUIT FITTINGS. — Bulletin No. 2126 issued by the Crouse-Hinds Company, Syracuse, N. Y., covers its "Obround" threadless condulets, form 7; its threadless connectors and couplings and the "Obround" covers and wiring devices.

ELECTRICAL EQUIPMENT.—The Hydro-Electric Power Commission of Ontario, Toronto, Ont., Canada, is distributing a booklet which is the first edition containing the list of electrical equipment approved by the commission.

TRADE DISCOUNT SHEETS. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing trade discount sheets, effective January 10, 1929.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency are desired in Amsterdam, Netherlands (No. 35,448), for storage batteries, parts and separators.

Purchase is desired in Panama City, Panama (No. 35,486), of a hydro-electric power plant.

Purchase is desired in Buenos Aires, Argentina (No. 35,477), of electric piano motors.

Purchase is desired in Berlin, Germany (No. 35,459), of electrical shaving appliances.

# Business Facts for Electrical Men

**Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business**

## Millions of Sales—Millions of Load Builders

PRODUCTION data of small electrical units have a bearing on many fields of activity. The manufacturers of the particular machines listed constitute only one of the groups at interest. Makers of associated products, jobbers and dealers, as well as men in the light and power industry, are also concerned.

The factory value of fractional horsepower motors produced in 1927, for example, attained the very respectable total of $32,504,952, according to reports made to the census of manufactures. These motors drive appliances in home, store and industrial plant. The cost of the motor is but a small part of the total price. In the aggregate nearly 3,000,000 vacuum cleaners, washing machines, ironers, sewing machines, refrigerators, oil burners and sundry other devices went with the motors made in 1927.

From some aspects the number of small motors is more important than their value. Compared with less than a million in 1921, the numerical output was doubled in 1923 and trebled in 1927. It might be urged that 1921 was a year of business depression, but the same argument does not hold against the spectacular changes in subsequent years.

During the same interval the average value fell from nearly $17 to $11.30. These are factory prices. What factors have contributed to the reduction cannot be determined from the statistics.

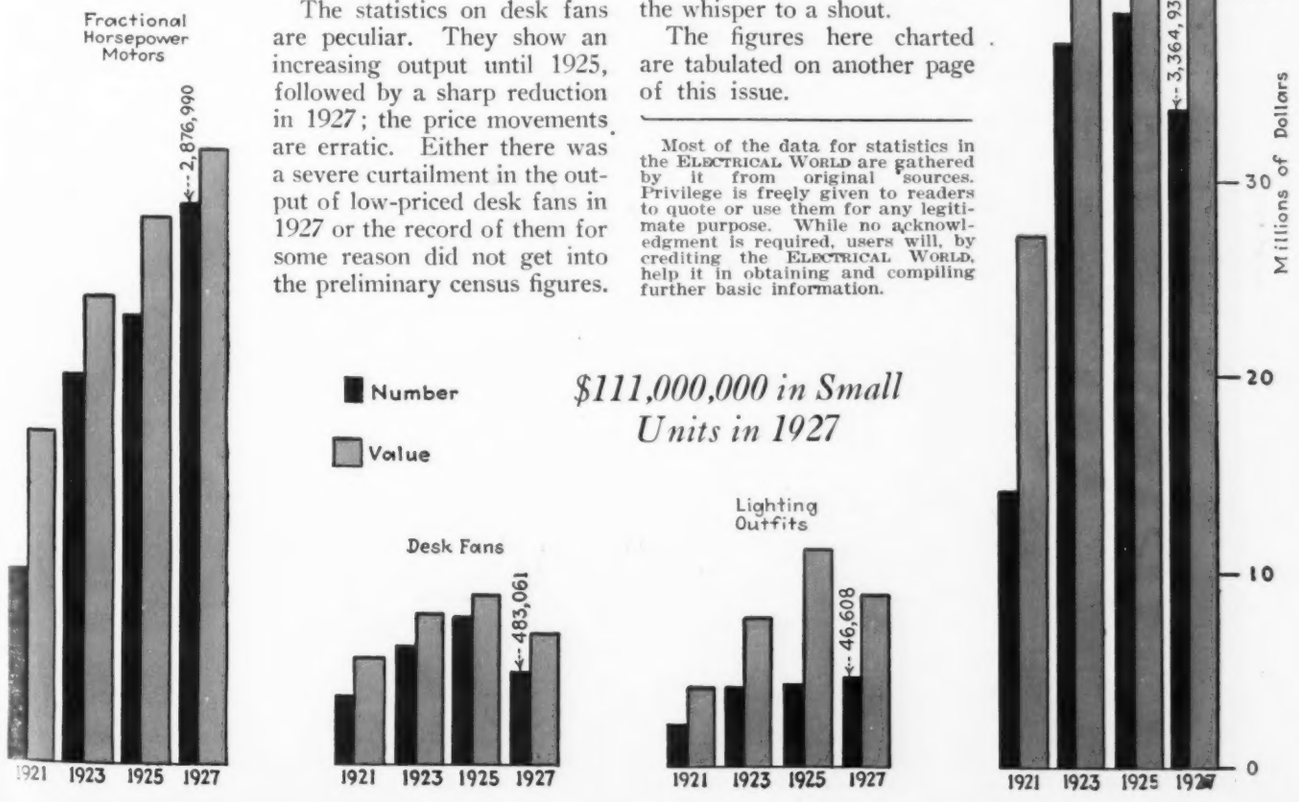
The statistics on desk fans are peculiar. They show an increasing output until 1925, followed by a sharp reduction in 1927; the price movements are erratic. Either there was a severe curtailment in the output of low-priced desk fans in 1927 or the record of them for some reason did not get into the preliminary census figures.

The production of self-contained lighting sets has exceeded 40,000 a year in each census since 1923 and shows a rising tendency. No doubt some are for replacements, but in the main they are for new installations as the number of farm lighting sets in the United States is believed to be around 300,000 to 350,000 and the majority must be fairly new. With rare exceptions every farm-lighting set installed goes in because the owner wants electric service and is willing to incur expense and inconvenience to get it. He would be a potential customer of central station energy if the circuits were within reach. He is a convert to the use of electricity and will never afterward do without it if he can get it.

And the millions of electric automobile starters whisper softly but insistently, every time the foot presses the button, "Do it electrically." The occasional failure, when the battery is run down, does not turn us permanently to hand cranking. It merely changes the whisper to a shout.

The figures here charted are tabulated on another page of this issue.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers to quote or use them for any legitimate purpose. While no acknowledgment is required, users will, by crediting the ELECTRICAL WORLD, help it in obtaining and compiling further basic information.



# Decreased Operations in the Middle Atlantic States

MANUFACTURING plants in the Middle Atlantic States witnessed a material decrease in the rate of operations during December as compared with November. A downward trend during December is a normal phenomena at this season of the year, but the decrease this year was considerably greater than would be expected from past years' performances. The December rate of operations, after corrections are made for the number of working days, was 5.4 per cent under that reported for November, but was still 15.4 per cent above the rate of operations reported for December last year.

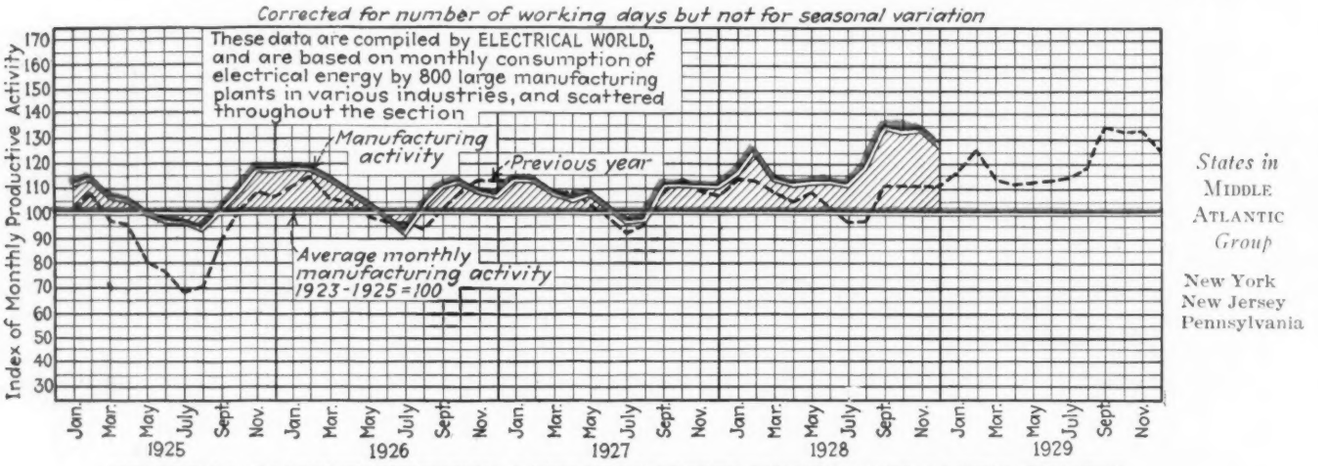
The year 1928 witnessed an average rate of general manufacturing activity in the Middle Atlantic States 13.7 per cent over 1927 and 11.8 per cent over 1926. The highest rate of monthly operations was recorded in September, while July witnessed the lowest operations during the year. The year was outstanding by reason of the very high operations recorded during the last third of the year.

The year closed with only three of the section's leading industrial groups—food products, leather products and paper and pulp—operating under December, 1927. Of special interest during the year was the high rate of operations in the metal industries group. Both the rolling mills and steel plants branch and the ferrous and non-ferrous metal-working branch witnessed rates of operations over those of 1927.

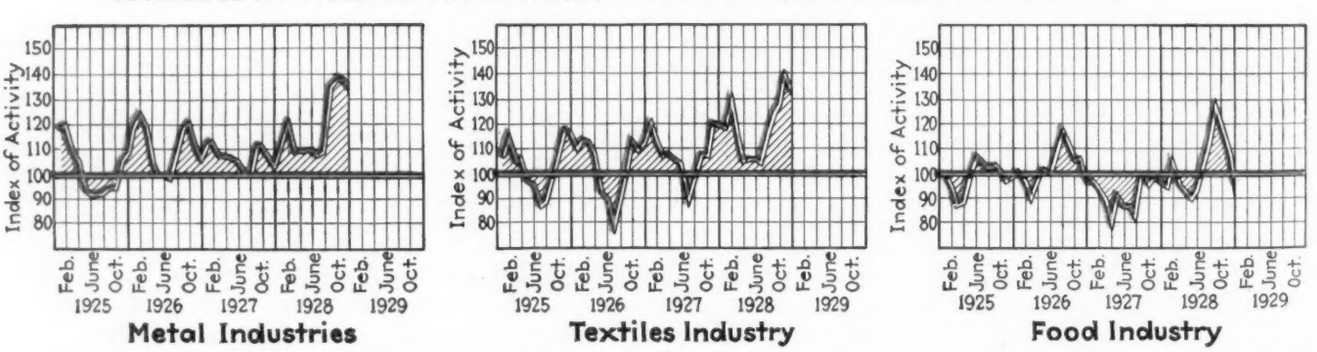
*Indexes of Productive Activity in the Middle Atlantic States*
All Figures Adjusted for Number of Working Days

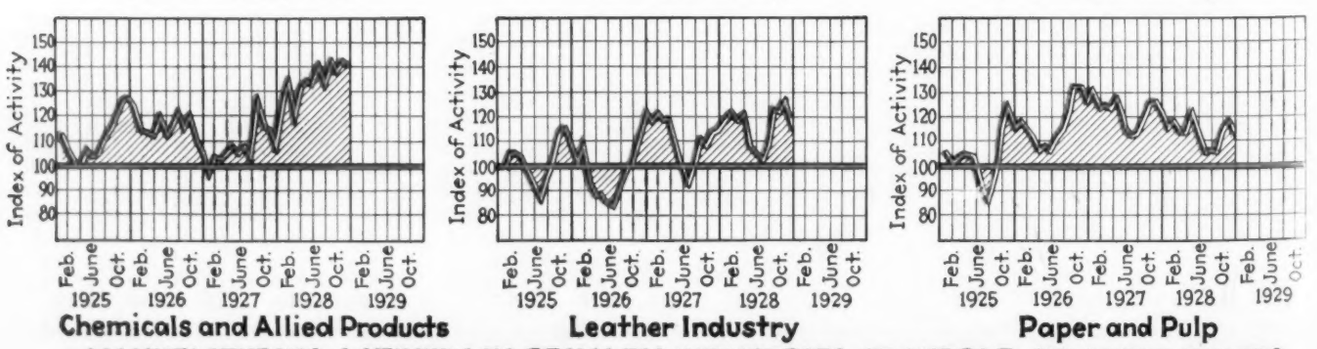
| | December 1928 | November 1928 | December 1927 | Average for 1928 | Average for 1927 |
|---|---|---|---|---|---|
| All industries | 126.8 | 134.0 | 109.9 | 121.2 | 107.5 |
| Automobiles, including parts | 123.7 | 116.0 | 104.0 | 159.1 | 101.5 |
| Chemicals and allied products | 140.3 | 143.3 | 107.3 | 135.8 | 108.4 |
| Food and kindred products | 90.2 | 106.1 | 97.0 | 102.2 | ..... |
| Leather and its products | 113.7 | 128.4 | 115.0 | 115.9 | 101.9 |
| Lumber and its products | 125.0 | 124.4 | 104.5 | 117.1 | ..... |
| Metals group | 133.0 | 138.9 | 101.4 | 119.7 | 107.7 |
| Rolling mills and steel plants | 135.8 | 143.0 | 101.4 | 122.8 | 105.6 |
| Metal-working plants | 130.2 | 134.5 | 101.5 | 116.5 | ..... |
| Paper and pulp | 110.5 | 118.4 | 123.5 | 112.6 | 122.6 |
| Stone, clay and glass | 137.8 | 144.6 | 97.6 | 130.7 | ..... |
| Textiles | 131.5 | 140.8 | 120.0 | 118.5 | 108.4 |

ELECTRICAL WORLD *Barometer of Industrial Activity in the Middle Atlantic States*


Corrected for number of working days but not for seasonal variation
These data are compiled by ELECTRICAL WORLD, and are based on monthly consumption of electrical energy by 800 large manufacturing plants in various industries, and scattered throughout the section
Manufacturing activity
Previous year
Average monthly manufacturing activity 1923-1925=100
Index of Monthly Productive Activity
States in Middle Atlantic Group
New York
New Jersey
Pennsylvania
1925
1926
1927
1928
1929

GENERAL MANUFACTURING ACTIVITY IN THE MIDDLE ATLANTIC STATES




MANUFACTURING ACTIVITY IN PRIMARY INDUSTRIES OF MIDDLE ATLANTIC STATES